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Vol. V. NEW YORK, FEB. 21, 1885. No. 8.

Handsomely bound volumes of THE ELECTRICAL WORLD *for 1884 are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

THE Bankers & Merchants' Company has long been lying by the roadside wounded and sore, but at last the Good Samaritan appears in the shape of the Postal Company.

OUR special illustrated article on telegraphic communication with moving trains will be read with great interest. There can be no question as to the accomplishment of the feat. The field for the invention is a wide one.

IT is announced that a French chemist has made butter by placing two electrodes in an insulated vessel of cream, so that the current segregates the butter. If he wishes to make a success of his plan, let him now go a little further, and learn to dispense with the cream.

THE Bentley-Knight system of electric locomotion continues to work admirably at Cleveland on the horse-car lines. Last week we announced that the Daft system is to be used there for the street cars, and now our Western correspondent reports that electricity will furnish the motive power for the projected elevated roads in Chicago. Why not?

WESTERN UNION declines again after a good rise, and it is reported that Mr. Jay Gould's brokers have sold at least 40,000 shares. The wonder is that it should remain as strong as it does. Manipulation of the market would probably account for all the changes, putting aside altogether the actual value of the stock and the earnings of the company present or to come.

THE reports of the Board of Examiners of the International Electrical Exhibition have begun to make their appearance. Some delay was to be expected, in view of the magnitude of the undertaking, and we now understand that the various reports will appear as rapidly as they can be put in shape for publication. The authorities of the Franklin Institute are no doubt doing all they can to get them out promptly.

NEXT month, or the time when the frost shall be fairly out of the ground, will see another boom in the construction of subterranean telegraphs. The companies seem to be in earnest in the matter of burying their wires, but they must wait for the first flush of spring—the underground constructionist is really proud of his "dig"-nity, but the effodient nature of his task prevents him from pursuing it in winter. This fact should be impressed upon the City Fathers of our large cities.

PARTICULARS are given in this issue of the tests made in England with an Edison-Hopkinson dynamo. Such an experiment is important as showing that confidence may safely be placed in the continuous running of dynamos, not only by electricians, but by those who rely on the electric light for their stores, factories and other establishments. A few more of these tests would not be amiss. By the way, when will the public learn the result of the special tests begun lately on two well-known systems, by the Franklin Institute?

THE French have not been so keen in their appreciation of the telephone as the people of this country, and to-day the number of instruments used by them is small. But they have made some very ingenious applications and modifications, and in dealing with various difficulties have been remarkably successful. To-day we publish an interesting illustrated article descriptive of the manner in which the telephone wires are carried through the great sewers of the city of Paris. Americans have something to learn in this respect from Frenchmen.

WE give to-day some further details in connection with the electric light convention which it is proposed to hold at Chicago next week. The principal questions to be discussed, it is said, are switching and switch-boards; care of apparatus; construction and maintenance of lines; aerial and underground wires; fuel and carbon points; consumers' complaints. These and other subjects will bear a vast amount of discussion without harm and with positive benefit to the business.

A CORRESPONDENT at Owego, N. Y., gives us two amusing examples of the ignorance that is still too prevalent in regard to the nature and character of the electric light. A plant having been installed lately at that place, an iron-molder has declared his intention of getting the job of lighting the new lamps every night, and another man of the old school vows that he will not pay 50 cents a gallon for electricity as long as he can get good head-light oil for 18, prophesying that the electric light will be a failure if they charge more than 25 cents a gallon for it.

AT Gelnhausen, in Cassel, Germany, a bust is to be put up of Philipp Reis, "the inventor of the telephone." It will stand on a pedestal of Swedish granite before the house in which he was born. The bust, modeled by the sculptor Karl Rumpf, of Frankfort, will be cast in bronze at Munich. This ought to satisfy Prof. Sylvanus P. Thompson, the bold advocate of the claims of Reis to priority in telephone invention. There is already a monument to Reis at Friedrichsdorf, bearing a portrait medallion, also by Rumpf, and erected by the members of the Physical Society of Frankfort.

ANCIENT mariners bewail the decay of seamanship consequent upon the introduction of steamers, and they are apt to look with alarm and disgust on every appliance which relieves the A. B. of some of his responsibilities. An invention has now been made that must well-nigh break their hearts. It is an electric automatic compass, the needle of which, by opening and closing the circuit, keeps a ship on the course laid down, without the intervention of any "man-at-the-wheel." All that is necessary is to set the compass—so the story goes—and the good ship makes a bee line for port. Such an invention might diminish the number of able seamen, but it would also be preventive of a lot of bad steering.

THE Board of Aldermen of New York adopted a resolution this week requesting the Gas Commission to furnish them with detailed information concerning the number and cost of the electric lights now being used in the streets, together with a statement as to the advantages or disadvantages of the light when compared with gas. The object of this step is not stated. There is said to be considerable apprehension on the part of Mayor Grace as to the effect that the late gas consolidation will have on prices. The city is practically at the mercy of the huge corporation representing the interests of the several companies, and prices for street lighting may be advanced at any time, without appeal, as they have been in other cities.

WE are glad to chronicle once more the fact that the operators are, so soon after the protest of 1883, once more organized in one strong body and once more nearly prepared to indulge in a neighborly argument with those who seek to oppress them. The experience of the operators of the Bankers & Merchants' Telegraph Company in working one month for a stated salary, and spending the next month in a vain hunt for the man who is to pay them for the job, and the experience of the striking messengers who had their Sunday privileges summarily curtailed last week, are forerunners of what other employés may look for in the near future. The operators must, at all times have an active, wide-awake organization.

IT looks very much as though the various cable interests had entered on a campaign of scandal and slander. On the one hand, Mr. Cyrus Field is complaining bitterly that his immaculate honor and stern integrity have been foully attacked in the late struggle over the Anglo-American directorship, and the Commercial Cable Company have issued a circular to merchants in this city denouncing the "many unjust and untrue statements" made against them by the German Union Telegraph Company, which, they point out, is a part of the "monopoly cable system." These statements have been published in Europe with the object of prejudicing the business public there against the Commercial system. The policy of mutual exasperation is not likely to be attended by any beneficial results.

FOR a long time the Baltimore & Ohio Telegraph Company have been endeavoring to set aside the exclusive contracts made between various railroad companies and the Western Union Company, whereby the Western Union Company enjoy the sole right to string wires along the tracks. Last year, the Baltimore & Ohio people sought to obtain a footing in New England, and to run their wires along the railroads, and later the fight was carried to the other end of the country, being renewed with vigor in the Southwest. At the present time the Baltimore & Ohio Company are seeking to exchange telegraphic business with such lines as the Union Pacific, the Kansas Pacific, the Missouri & Southern Pacific, the Northern Pacific, and the Atchison, Topeka & Santa Fé. So, far, however, no great progress has been made, the railroad companies preferring apparently to avoid negotiations. It appears that Mr. Bates, president of the Baltimore & Ohio Company, has been indefatigable in his efforts to get necessary information from Mr. C. F. Adams, president of the Union Pacific Railway Company, but his wishes have not yet been gratified. We give details elsewhere of the controversy. It is said that this matter will be brought to the attention of Congress, as the roads named have been liberally subsidized by the government.

LIGHTING MEN-OF-WAR.

In another column there will be found the results of a series of experiments which were instituted by the British Admiralty, for the purpose of ascertaining the relative cost of oil and electric lighting on board of a man-of-war. Whatever might have been the results of these trials, whether in favor of oil or electricity, the object to be gained by them appears to us of little or no value. Leaving cost out of consideration for the moment, no one, we believe, will dispute the superiority of the electric incandescent over the oil lamp. On shipboard, especially, where *safety* is of the first importance, the two will bear no comparison whatever; and this safety so necessary on ordinary craft acquires an additional prominence on board of a man-of-war, always loaded with explosives, and where, therefore, an outbreak of fire might be followed by the most disastrous consequences.

The convenience and applicability of the electric light on shipboard have so often been pointed out that it would be idle to repeat them here, and the best evidence that can be adduced in support of them is the increasing number of ships fitted up with one or another of the incandescent systems.

As regards cost, we believe that it has long ago been set down as a maxim in military and naval administration that where efficiency and convenience are concerned cost is of secondary importance, so that even on that score alone the oil lamp must pale in the presence of the incandescent.

Granted that oil should have been found to be cheaper than electricity, would that fact in any way militate against the electric light on shipboard? We should say, most decidedly not; for the merits of the latter are now too well recognized to admit of any revulsion of feeling in the matter. What there is to be gained, therefore, by the experiments mentioned above, is not very apparent. Whatever the final results may be, they will hardly effect a change of existing conditions, while, as regards the future, no fears need be entertained with respect to the electric light on board ship.

Permanent Magnetism.

BY C. C. HASKINS.

The great forces of nature are universal, and amenable only to her laws. Light, heat, the various forms of cohesion, attractions ever act, under the same conditions, with unerring certainty, with unvarying results. While to the scientist and philosopher each of these, when investigated, is not only interesting and instructive, there are special exhibitions which have peculiar interest to the student and experimenter in the fertile field of electrical research.

Magnetic attraction is one of those forces which deeply concerns students of this class. It is a factor in all measurements where the galvanometer is used, and is at the same time a help and a hindrance to accuracy. It is the vital element in that instrument, and it is so universally distributed throughout the earth that, like electrical induction, it becomes necessary to fight its vagaries, to ward off error. "The earth is a great magnet," is an axiom, but the many manifestations of the universal distribution of this force, its permanent effect on bodies capable of being acted upon by it and of retaining this mysterious power, are in general but little understood.

One of the most ordinarily observed exhibits of retained magnetism is found in the tools, and especially the files, in a machine shop. Hardly one of these but will be found, if examined, to have attracted small particles of iron, which form themselves into the curved lines which we know as lines of force, and yet not one of them has been nearer than the earth's pole to any source of magnetic influence.

With a cheap pocket compass one will be surprised to learn how widely this influence is distributed. If we place it close to a stovepipe, for instance, the needle is attracted. The pipe is iron and this result is natural enough. Now, without changing its horizontal position, carry it up along the pipe, past a joint, and it will show a different polarity by reversing the compass needle.

Steam coils will often do the same on testing their differ-

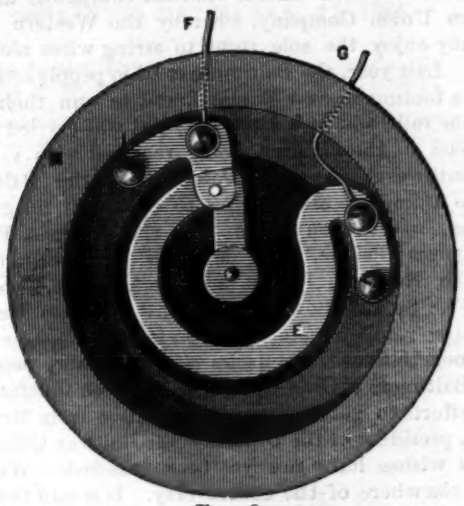


FIG. 2.

ent extremities—especially if these are placed in the magnetic meridian.

The north and south sides of a letter press will often show magnetic polarity in the same manner, and the truss rods of a roof have similar peculiarities.

An entire package of fine cambric needles which had lain in one position for some time were so perfectly polarized that when floated, by carefully dropping them on water, the points invariably indicated the magnetic north.

Railroad irons, in a due east and west line, have been shown to have transverse polarity, while those lying in or near the meridian were polarized throughout their length.

The minute hair springs of a watch are often influenced in this way to a degree easily shown by an ordinary pocket compass, and this, too, when taken fresh from the original package. So of the tiny screws and other steel portions of watches which have undoubtedly contracted this force by remaining a long time in one position, just as a fire poker does when taking its summer rest, or the stovepipe, standing erect for months at a time.

Is it any wonder, then, that in these days of accuracy and precision, so delicate a piece of mechanism as a watch should vary from the standard, and become "A thing of worry, and a plague forever." The belief is coming to be quite prevalent that nearly every watch has more or less of permanent magnetism. The same test—the compass—will often show this, if the two are laid side by side, touching each other. If the watch be now carefully revolved horizontally, the needle will show an inclination to reverse, provided the steel portions of the watch are so affected.

It is undoubtedly true that, if the watch were to be maintained in one position the deleterious effect might be counteracted by adjustment; but inasmuch as it is a pocket instrument, and is hardly in the same position more than a few moments at a time during the day, it is fully as apt to increase as to diminish its magnetism, and as a matter of fact, such watches appear, as a rule, to become more rather than less magnetic.

Be this as it may, the fact remains that scarcely a plate or bar of iron can be found anywhere—even tin fruit cans will sometimes show it—that will not indicate a magnetic condition.

Hill's Patent Electric Fire-Alarm Thermostat.

This invention is the application of the principle that when a spring electrode is held out of contact with a neighboring electrode by means of an easily fusible metal, an electric circuit may be completed by the fusion of the metal, permitting the two electrodes to come in contact by the elasticity of one of them; the fusion being caused automatically by the heat of an accidental combustion in the compartment of a building.

Fig. 1 represents a sectional view; Fig. 2 an inside view not in section, and Fig. 3 a general outside perspective view.

The device, as constructed and represented, is noticed to consist of an outer box or casing, with its open side lying upon a foundation or bed-plate, to which it is securely fastened by a screw joint, so that it may be removed for readjustment. When screwed together, the box is com-

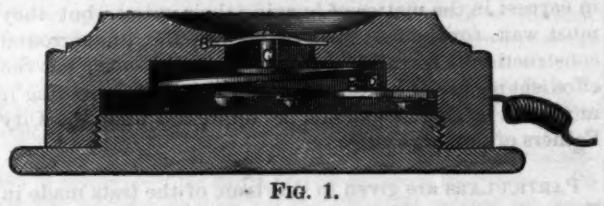


FIG. 1.

pletely closed with the exception of a small opening in the top of the case, adapted to be closed by a fusible solder joint. Just below the opening is one end of a nearly flat spiral spring *E* of about one coil, which connects with one pole of the battery, while below the spring is located the terminal of the opposite pole, both terminals *D* being tipped with platinum.

In the opening is inserted a copper annulus *B* in a peculiar manner. The perforated disc or annulus is somewhat conical, so that when placed in the hole opposite an annular groove and resting upon the end of the spring, and hammered flat or nearly so, it becomes imbedded in the groove tightly. A little piece *A* of metal in fusion, and possessing a fusing point of about 150° F., is allowed to drop into and about the little hole in the copper disc, so that it becomes closed, and the two electrodes are held out of contact. When the bed-plate is screwed upon the instrument proper, the combination becomes impervious to water or other liquid, and may even be placed therein without change or injury.

The uses to which this instrument is adapted are numerous. In all mills and large manufacturing establishments there are a great number of journal and other bearings which are not only secluded from observation, but which from their number alone cannot be constantly watched. It is not unusual for fires to occur from the heat generated from friction at such points. Even when the damage is not great, the loss of time in a large establishment from the stoppage of machinery is a serious consideration.

The thermostat may be attached to the journal-boxes or contiguously thereto in such a manner that the heat therefrom may be communicated to the solid joint easily and without delay. Each bearing may be supplied with one of these thermostats, and the wires may be carried to any desired point where it is expedient to sound the alarm and designate the locality of the heated journals. The in-

FIG. 3.

strument may also be applied to railway train car axles, to steamboats, in the rooms of hotels and other places.

The solder plug is made of a combination of various metals, the object thereof being that it shall fuse at a comparatively low temperature, ranging from 110° to 212° F. Heretofore a composition has been used consisting of lead, tin and cadmium, which would melt at 155° to 160° F., and in localities where fusion is not required at lower temperatures, Mr. Hill uses the same. In many places, however, a much lower fusion-point is desirable, ranging as low as 110° F. For the latter temperature he uses a composition of the several metals named above, with a small portion of mercury, and thereby obtains a solder which will readily fuse at temperatures of 110° to 140° F. The quantity of mercury employed depends upon the point at which fusion is required, the greater the proportion thereof the lower being the point of fusion. By setting the solder plug in a thin copper disc and blackening the latter, rapid absorption of heat is obtained, and the automatic circuit-closer is rendered more rapid and reliable in action.

Honolulu, Sandwich Islands.—This city of the Southern Seas is extending its telephone system. The Western Electric Company has just received an order for fifty complete sets of instruments to go there.

A Lecture on the Edison System.

A special meeting of the Society of Arts was held at the Institute of Technology, Boston, Mass., on Feb. 3, to listen to a paper on "The Edison Central Station Electric Lighting System," by Mr. W. J. Jenks, superintendent of the Brockton (Mass.) plant. The paper, with the subsequent discussion by prominent electricians, developed a number of facts of great practical and commercial importance, but which are familiar to most electricians.

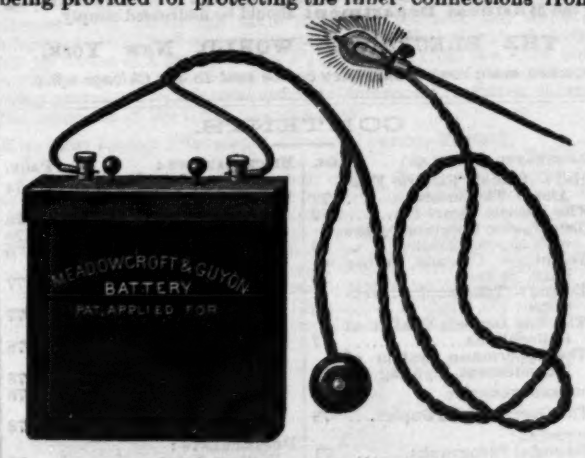
At the conclusion of the paper, Mr. Jenks introduced Mr. W. L. Garrison, the treasurer and originator of the Brockton company, who gave a number of interesting facts regarding the commercial aspect of electric lighting. In response to inquiries, Mr. Garrison stated that the expense to the consumer had been fixed at 1 cent per hour for a 10-candle lamp, this being on the basis of gas at $3 per 1,000 ft., to which price the gas in Brockton immediately fell upon the introduction of the electric light.

In Lawrence the Sprague motor, giving from one to three horse-power, is being used in the same circuit as the lamps with satisfactory results, and the number of lamps connected is nearly 2,800.

Mr. C. J. H. Woodbury stated that the total number of Edison lamps in this country is 109,800, of which 34,800 are connected with a central station, and 75,000 are in individual plants.

The Electric Scarf-Pin.

Our readers have already been informed through these columns of the various ways in which the little incandescent lamp is made to shed its soft light from various articles of jewelry. The effects produced are quite brilliant and highly amusing, and never fail to attract attention. One of the most popular articles of electric jewelry is the scarf-pin, which is shown in the preceding column, in connection with a battery and push button. The lamp attached to a pin is a small Edison incandescent of one-half candle-power, and from it wires lead to the push button and battery. The latter is contained in a hard rubber casing, and consists of a modified Bunsen cell, means being provided for protecting the inner connections from



corrosion. The whole thing weighs but a few ounces and can be carried conveniently in the hip or coat pocket. The wires are passed under the clothing, and the push button may be placed wherever most convenient, either in the hand or coat pocket. By pressing it, the circuit is completed and the lamp gives forth its light. The apparatus is manufactured by Messrs. Meadowcroft & Guyon, of 23 Ann street, this city, and, in addition, the battery, on account of its high electromotive force, can be used for testing circuits, its small weight making it very convenient, where a battery has to be transported from place to place.

A Very Rapid Installation.

Reports come from England of a very rapid installation of the electric light made a few weeks ago by Messrs. Woodhouse & Rawson on the occasion of the bachelors' ball which took place at the Crown Hotel, East Grinstead. The interior of the rooms was lighted by incandescent lamps, and the exterior of the building and the High street by arc lights, which burned with remarkable brilliancy and steadiness, illuminating the street on either side for a considerable distance, the effect being greatly enhanced by the fact that the ground was covered with snow, making it to have all the appearance of daylight. The installation consisted of two Marshall engines of 7 horse-power, two Bürgin machines, 100 Woodhouse & Rawson incandescent lamps, and two Crompton arc lamps of 3,000 candle-power. The whole of the wiring in the house was completed with sufficient care for a permanent installation, the joints being all carefully made and properly insulated. The electroliers, designed specially for the purpose, were completely covered with evergreens, eight being used in the ball room with four lights each, and four in the supper room with eight lights in each, the others being similarly distributed in the sitting rooms, hall and passages. The whole of the work was completed in three days, the dynamos only arriving late the night before the ball. In addition to this, a shed 25 feet by 40 feet had to be constructed for covering the engines and dynamos. The plant was started for the first time at four o'clock on the afternoon of the day of the ball, and ran throughout the ball, which was kept up until 4:30 in the morning, without a break or stoppage of any sort.

Telegraphic Communication with Moving Trains.

To send and to receive telegrams on a train moving at the rate of thirty miles an hour, with the same facility as in any telegraph office, will be admitted to be a noteworthy feat; but that it has been successfully accomplished admits of no possible doubt. As in most inventions of merit, the means employed are quite simple, and the invention acts upon principles that have long been known and applied.

Before entering upon a description of the system by which such marvelous results are obtained, we will give our readers some idea of its capabilities by recording some of our tests of it, made in the company of Mr. Lucius J. Phelps, the inventor. The stretch of railroad now fitted up with this system is about 13 miles in length, and extends from the Harlem River to New Rochelle Junction, on the Port Morris Branch of the New York, New Haven & Hartford Railroad.

Before entering the train at the station, a visit was paid to the terminal telegraph station, which is about fifty rods from the depot, and the operator was instructed to watch for a message which would be thrown from the train, and to answer it. Upon entering the train we wrote a message, which no one but ourselves saw, and sealed it in an envelope. The message read: "Let me know your name and address." The train then moved out, and while passing the telegraph station at a fair rate of speed the envelope was thrown from the car. The wind being strong at the time, the paper was wafted some distance, and the operator could be seen hunting for it; just then the train turned a curve and he was lost to sight. Before a half mile had been passed, however, the following answer came in, clear and distinct, at the rate of twenty words per minute:

Mr. J—— W——:

My name is Henry Lewis, 428 East Fourteenth street, N. Y.

HENRY LEWIS, Operator.

After this message had been received on board the moving train, we wrote out another dispatch, to be transmitted to our offices, at No. 9 Murray street. In order to satisfy ourselves, we had the message repeated back to the moving train immediately after its transmission, and it came back without an error. On arriving at our offices after the trip, we found the dispatch exactly as it had been transmitted. During the remainder of the trip, which lasted about half an hour, and extended over nearly 12 miles, questions and answers were sent to and fro, between the train and the station, without the slightest trouble or delay. If, therefore, any doubts may have existed in regard to the practical success of the system, they must be dispelled by such facts as are recited above; and we venture to say that, before long, this stretch of 12 miles will be increased to hundreds, and even thousands of miles.

With this brief sketch of the capabilities of the system, we now come to the explanation of its details and manner of operation. The principle upon which the whole system is based is that of *induction*, according to the law that if a current be sent through one of two parallel wires in close proximity to each other, the second wire (on closed circuit) will have a momentary current *induced* in it, the direction of which will be contrary to that of the primary or *inducing* current; while, if the primary current be interrupted, the induced current will be reversed, *i. e.*, turned in the same direction as the primary current. By utilizing this oft-applied principle, therefore, electrical effects and currents are obtained *at a distance* from, and *without contact* with, any source of electricity. Thus, if in Fig. 1, a current be sent through the bottom wire *A*, a momentary current will be set up in the parallel coil *B C*, which current can be utilized to actuate a relay, and through it a sounder. While this particular employment of an induced current to actuate a relay is not in itself new, its modification and adaptation to the present system must nevertheless be allowed to exhibit a high degree of inventive genius, which was acknowledged by the granting of very broad patent claims.

By referring to the diagram Fig. 1, the general arrangement of the sending and receiving stations will be seen, that to the right representing the moving car. This arrangement has, however, been modified, for reasons which will appear presently.

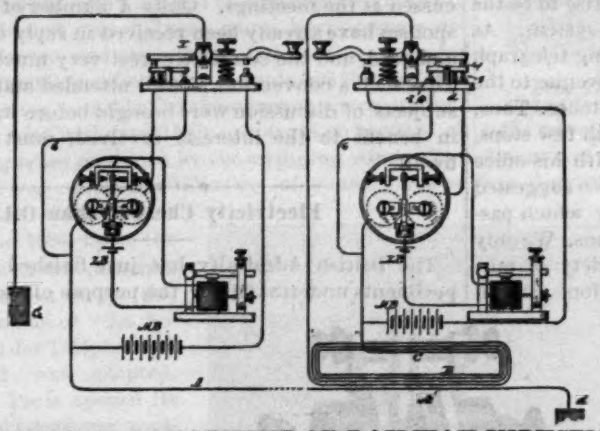


FIG. 1.—GENERAL ARRANGEMENT OF RAILWAY INDUCTION TELEGRAPH.

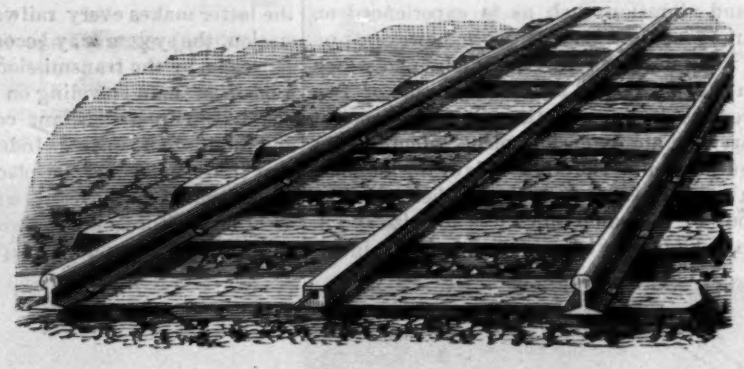


FIG. 2.—THE MAIN LINE WIRE.

Taking the terminal station first, we find its principal equipment to consist simply of a main battery, a pole-changing key and a telephone, the latter taking the place of the relay and sounder shown in Fig. 1, and all connected in the usual way with the line wire.

In this system the line wire is run between the rails, and consists of an insulated copper wire laid in a covered trough composed of strips of wood hollowed out to receive the wire. Fig. 2 shows the manner in which the wire is secured and protected, the inclosing strips resting upon blocks secured to the cross-ties. An ingenious machine has been devised by Mr. Phelps for the purpose of shaving the tops of the blocks to the same level, notwithstanding the unevenness of the cross-ties; but our limited space prevents us from entering into a description of it here. When finished, the top of the box containing the wire is a little below the level of the rail. At switches and crossings, where a rail crosses the track upon which the wire is being laid, the grooved strips containing the wire are brought up on opposite sides of the rail, and the wire carried in a stout rubber tube under the rail and from one grooved strip to the other. Similarly, at highway crossings, where the road is planked over on a level with the rails, a groove is cut in the planking on the road-bed in line with the boxing, and sufficiently large to receive a ¼-inch gas-pipe, which is fastened down in the groove with staples, and the insulated wire passed through. In the present instance, a No. 12 insulated wire is used; but for a regularly equipped road it is proposed to employ No. 8 wire, for obvious reasons.

The external appearance of the car equipped with this system is shown in Fig. 3. It differs from the ordinary car only in the addition of a pipe running below and along the centre of the car between the trucks, and hung by suspenders. This pipe is situated directly over the line wire, at a height of seven inches, and consists of a two-inch gas pipe. This pipe contains a 1¼-inch rubber hose, in which the induction wire of the car is incased. It consists of No. 14 copper wire, single braided and paraffined. One end of this is first drawn through the pipe, passed up to the ceiling at one end of the car, back to the other end, then down and into the pipe, and the operation is repeated until ninety convolutions are completed. This forms a continuous circuit about 1½ miles in length, and presenting about ¾ of a mile of wire parallel with the main line wire upon the track. The circuit throughout is inclosed in a rubber hose, the object in carrying the return leads along the top of the car obviously being to separate, as far as possible, those portions of the wire in which the current moves in opposite directions.

The terminals of the wire so wound around the car are brought together and carried to a transmitting key placed on top of the small compartment situated in one corner of the baggage car, as shown in Fig. 4, which represents the moving telegraph station. The equipment of this station consists of a transmitting key, a "buzzer" or vibrator, a sounder, a polarized relay, and a battery of five quart cells, one of which constitutes the local battery. The terminals of the coil are carried to the key, and connect through the back contact of the latter with the polarized relay, shown in Fig. 4, the construction of which will be explained presently. This is the receiving instrument on the car, and closes the local battery circuit through the sounder, which is placed on a sounding-board supported by brackets above the relay. For the transmission of messages from the car, the current from the four cells is passed through the front contact of the key before mentioned, through the 1½ miles of wire in the coil, and through the buzzer, which breaks the current very rapidly and converts the single "click" into a humming sound. This rapidly vibrating current induces similar currents in the main-line wire on the track, and the operator at the terminal station reads the Morse characters from a telephone, which reproduces the humming of the "buzzer." If it is desired to receive a message in the car, the operator at

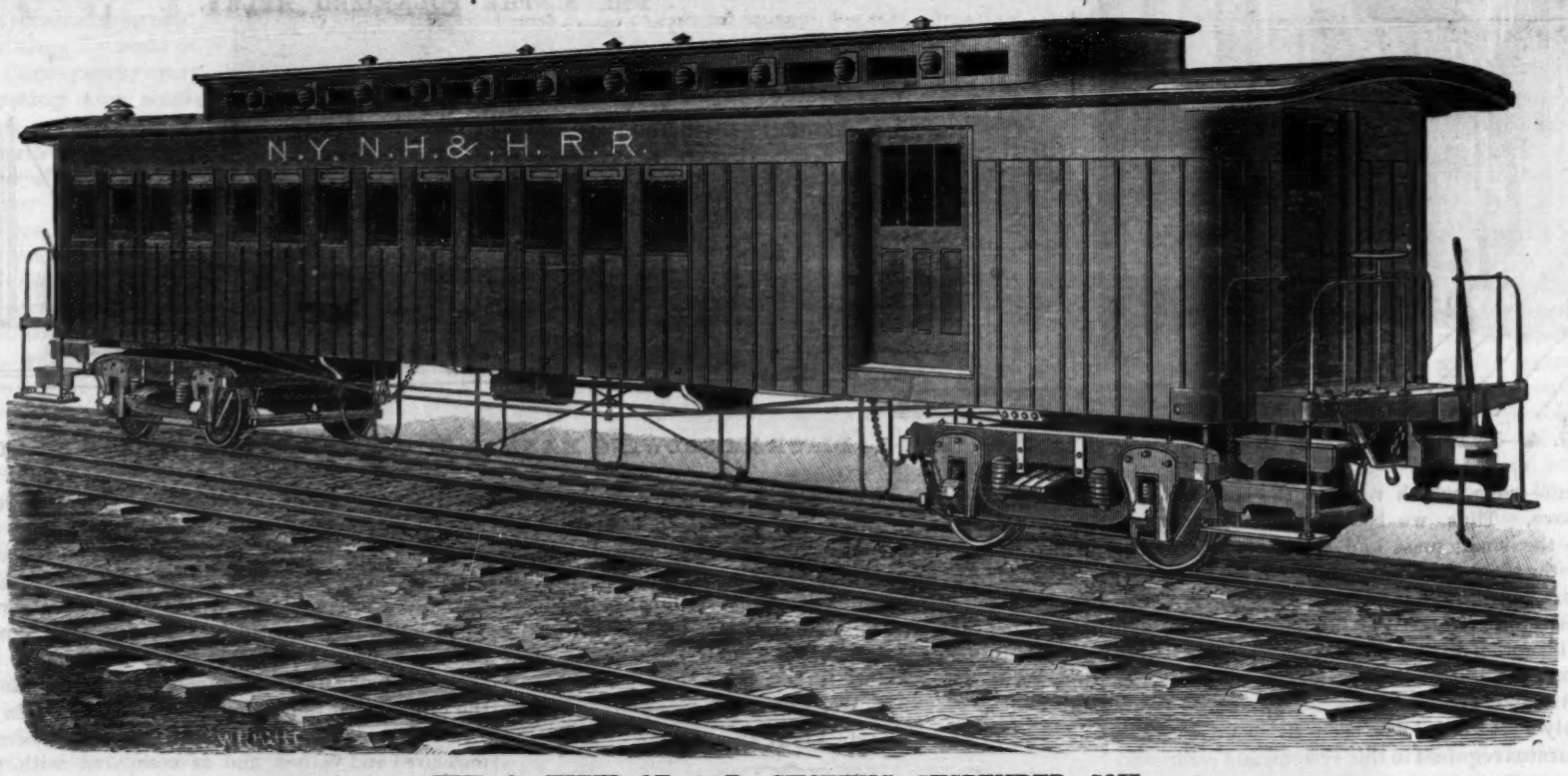


FIG. 3.—VIEW OF CAR, SHOWING SUSPENDED COIL.

the terminal station merely manipulates his key in the usual way, and the pulsations of the current in the main line induce corresponding effects in the wires placed a few inches above it on the car. The induced currents actuate the delicate relay, and the sounder gives forth its signals in the same way as usual, and can be easily heard at a distance of ten feet even above the din of a moving train.

It is evident that the terminal station might employ a relay and sounder in place of the telephone, but the latter is naturally the most convenient, as it requires only a small battery on board the train. Again, the telephone might, with equal facility, be employed as receiver on board the train, but it was found that the noise which always accompanies a moving train prevented a distinct understanding of the signals. A relay was, therefore, necessary, and one the principal requirements of which were two-fold. In the first place, a very delicate relay was required for the reception of the very weak induced currents; and, secondly, one in which the armature should not be affected even by strong jarring and vibration, such as is experienced on trains. These antagonistic elements were, however, provided for in the relay designed by Mr. Phelps and which is represented in Fig. 5. It will be seen to consist of two steel magnets, bent as shown, with their like poles brought together and carrying an extension piece which has a V-shaped groove at the top. The other ends of the magnets carry extension pole-pieces and fine wire helices. The armature is about of the same thickness and size as a 3-cent nickel piece, but its lower edge is straight and thinned down to a knife edge, which rests in the bottom of the V-shaped groove. Thus we have friction entirely removed, while the small mass and short leverage of the armature, together with the strong magnetic field in which it is placed, prevent its moving under shock or vibration. It responds, therefore, only to the impulses sent through the coils, and its action during the test at which we were present left no doubt of its delicacy, and, paradoxically, of its shock-resisting power.

Thus far, only a single car has been fitted up with the necessary apparatus required in this system, and communication between two moving trains has not yet been tried. There seems to be little doubt, however, that this is feasible. In actual practice, however, it would not, except in rare cases, be desirable to have intercommunication between trains, as it would interfere with the functions of the train dispatcher, who alone should govern their movements. The diagram, Fig. 6, shows the manner in which a way station would be brought into communication with headquarters on a newly-built road. Similar to the car it would have a coil parallel to the line wire, and, like the terminal station, a telephone as receiver, by which it could receive and transmit as easily, and, if anything, more conveniently, than the former, since the length of the parallel wire is not limited to the distance between the trucks of the car.

In transmitting from the terminal station to the car, a battery is used which will give a current of about 1½ ampères over the line, and is manipulated by a pole-changing key. It is clear that the latter is not absolutely necessary, as the induced currents on the car are reversed at opening and closing the main-line curcuit. By the use of the pole-changing key of a special design, an increased effect is obtained, however

The plant now in successful operation comprises 12 miles of track, of which about 3 miles are trestle-work. There are 12 stations on the route, two rivers with drawbridges, one requiring 110 feet of cable, and the other 175 feet, and 47 highway crossings (one of which is 65 feet in length) where the wire is carried in an iron pipe.

The principal object of the invention is, of course, the governing of the movement of trains and the prevention of accidents, and it must be plain to all that for this purpose it presents every advantage. In the first place, it puts the train dispatcher in direct communication with every train on the line, no matter where it may be, and whether it be moving or stationary. Again, if the train be on a siding of a single track road, a shunt from the main wire on to the siding keeps the train in constant communication, so that it can immediately receive its orders to "hold on," or to proceed whenever the track ahead is clear.

Another item is worthy of note, and may rise to be the most important one for railroads using this system. As the latter makes every railway train a moving telegraph station, the system may become a source of revenue to the railroads, by the transmission of private dispatches. Thus, a business man traveling on a fast train with few stops, could keep up a constant communication with his office and facilitate business. Indeed, it has even been suggested that stock "tickers" be placed in trains, by which passengers could be furnished with stock quotations. We only mention the foregoing to show to what a variety of purposes the system could be applied; but time alone can tell what its capabilities are. That it is able to accomplish its primary purpose, however, has, we believe, been fully demonstrated, so that it now only awaits an extended application. The system, which is patented, is now controlled by the Phelps Induction Telegraph Company, of No. 13 Park Row, this city, to whom we are indebted for the courtesy extended to us in a thorough examination of their system.

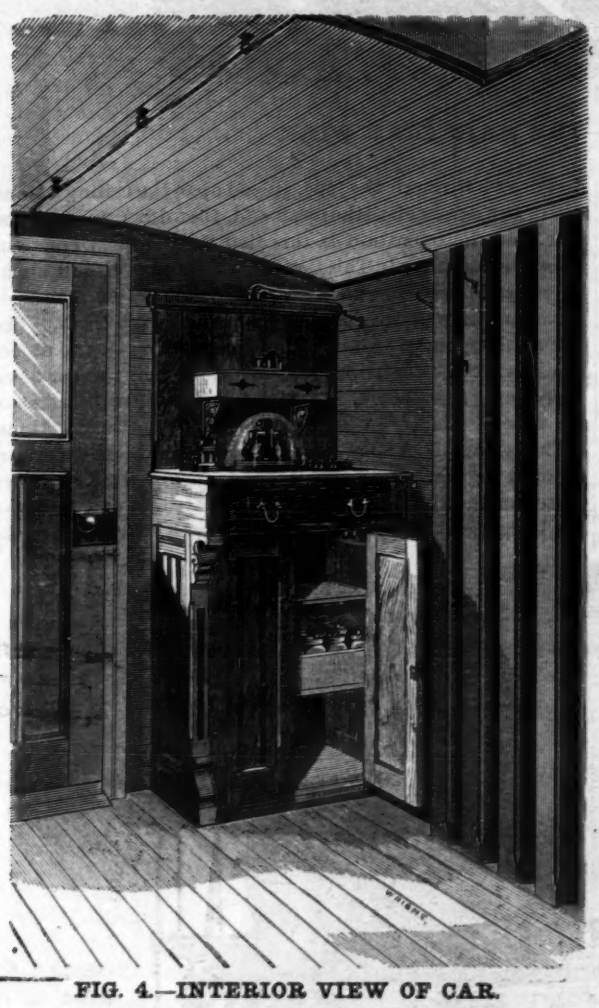


FIG. 4.—INTERIOR VIEW OF CAR.

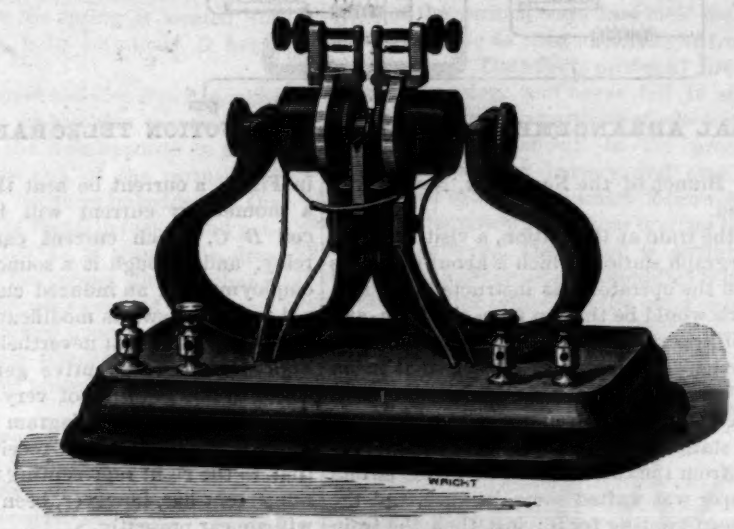


FIG. 5.—THE POLARIZED RELAY.

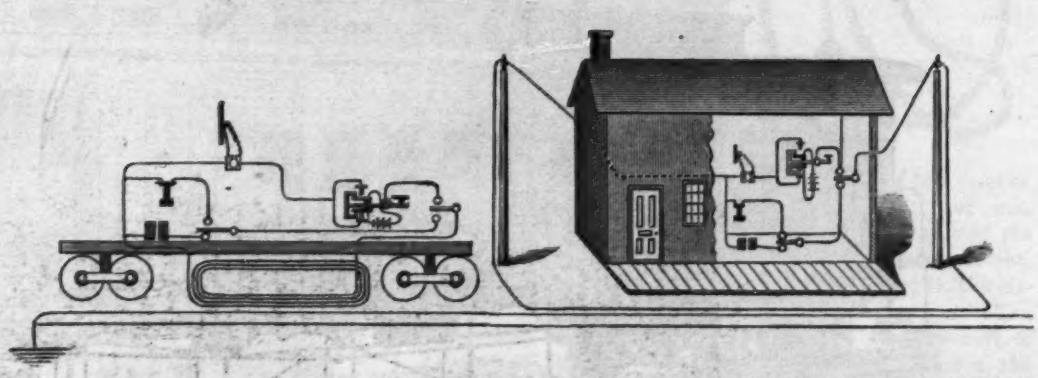


FIG. 6.—DIAGRAM SHOWING MANNER OF COMMUNICATING WITH WAY STATIONS.

The Electric Light Convention.

The matter of the electric light convention at Chicago is being vigorously pushed, and the present indications are that it will be fairly well attended by representatives of the different companies doing business in the United States and Canada. The local electric lighting people are taking steps to see that all visitors have adequate accommodations ready for them on their arrival. The committee on invitation have prepared and sent out a circular, in which they say:

"The meeting is particularly called for the benefit of those interested in the business of electric lighting; not especially the manufacturing companies, but all interested in the operating of electric light plants. It is desired that a conference of those interested as above should be held, that there may be a general interchange of ideas to the end that the most perfect as well as the most economical method of operating may be brought out. The following are some of the principal questions to be discussed:

"Switching and different systems of switch-boards employed.

"General care of electrical apparatus. 1st. Dynamos. 2d. Lamps. 3d. Lines.

"Construction and maintenance of lines.

"Aerial and underground lines.

"The fuel and carbon questions.

"Complaints of consumers, and any and all other questions which may properly come before such a meeting.

"Those to attend are requested to note and be prepared to bring to the attention of the meeting any peculiar circumstances which have come to their notice with especial reference to their particular locality, and also any climatic influences.

"Several eminent electricians are expected to be present, and much valuable information will be gained by an attendance."

This circular is accompanied by a postal card addressed to the secretary of the committee, on which are blanks to be filled in by the recipients with the name of the person who will represent them at the convention, and with any subjects which they think it would be well to have discussed at the meetings. Quite a number of favorable responses have already been received in reply to the circular and card, and the committee feel very much encouraged. That such a convention, if well attended and if the proper subjects of discussion were brought before it, would result in benefit to the interests involved, must be admitted by all.

Electricity Cheaper than Oil.

The British Admiralty has just finished a series of experiments undertaken for the purpose of ascertaining the relative cost of oil and electric lighting on board of the man-of-war "Colossus," at Portsmouth. Each trial lasted one week, and the dynamos were run continuously during the interval by day and night, the ship being lighted under the practical conditions which would be observed at sea. The result turned out to be a most gratifying one for the electric light.

No hitch of any kind happened to the machinery during the crucial ordeal, and only a few breakages in the lamps. The coal and oil used in the trial have been carefully measured and valued, and as compared with the simple cost of oil lighting it is computed that the electric lighting is the *cheaper* by *at least one-half*. As the comparison stands, however, the London *Times* says, it is unfair to the electric light. The engines which have been used for circulating the water through the condensers and driving the fans would at sea be required for the auxiliary engines and the common ventilation of the ship, and hence it would be unjust to charge all the coal consumed by them to the dynamo-driving engines. It has been consequently deemed necessary to run the circulating and fan engines for an additional 24 hours in order to determine the exact quantity of coal required to drive them, of which a proportional amount only will be placed to the account of the electric lighting.

As regards a comparison between lighting by "oil" lamps and the incandescent lamps, says a contemporary, that has not as yet been accurately obtained, although the consumption of oil and coal was carefully measured and valued. However, from a general comparison with the simple cost of oil lighting it was computed that the electric lighting was cheaper by about one-half. So far as can be seen at present, the experimental trial has been decidedly in favor of the electric light.

Telephone Circuits in the Paris Sewers.

The discussion which has raged for months in this country, regarding the removal of overhead wires and putting them below ground, has drawn attention to the ease with which the Parisians have found a way out of the difficulty. There, the wonderful network of sewers, the work of the great engineer, Belgrand, and his eminent colleagues, Alphand, Les Huet and others, affords every facility for the passage of cables and other conduits. Indeed the Paris sewers may rightly be claimed to be one of the chief "attractions" of the city, and visitors rarely leave without paying a visit to the subterranean passages, which have obtained a world-wide renown.

When the telephone was first introduced in Paris, the small number of subscribers permitted the use of overhead lines; but, as the number increased, it soon became apparent that some other method of running them would have to be adopted, especially as many house-owners demanded 500 francs, and some even 1,000 francs a year for granting the privilege of erecting a single bracket on the side of a chimney. Added to these persons were a number of others who withdrew their privileges on account of the humming noise produced by the swinging wires. The most natural way out of the difficulty, of course, was to run the wires through the sewers, and in 1880, upon the consolidation of the principal companies into a single one bearing the name of "La Société Général des Téléphones," this method was adopted. The city of Paris opened its sewers to the telephone company, in consideration of a rental, and the telephone wires found a resting place near the telegraph wires, which had already been placed there. The city let out a space 30 centimetres (about 12 inches) wide and 10 centimetres (about 4 inches) thick along the vault of the sewer, which allowed the company to attach the triple hooks shown in Fig. 1, and on these 51 cables of 40 conductors each are hung. All telephone circuits in Paris are metallic, no ground returns being used, the object being to avoid induction. Consequently every circuit requires two single conductors, and these are twisted together and covered with a layer of cotton of the same color. Seven such double wires, covered with different colored cotton in order to distinguish them easily, are wrapped about with tarred tape and inclosed in a lead pipe, which is redrawn after the wires are inserted in order to make a close-fitting covering.

These multiple cables of 14 wires, constituting 7 conductors, inclosed in lead, have an external diameter of 18 millimetres, and they are worth from one to two francs per metre, according to the current price of lead, copper and gutta-percha. The length of the cable is about 400 metres, and it is only at the end of one of these sections that the individual circuits are soldered and led out into the buildings occupied by the subscribers. These single circuits are also covered with lead and are carried in a small trench under the side-walks into the respective buildings. The small cables are 8 millimetres in diameter, and are said to have a resistance of 30 ohms per kilometre (⅝ of a mile), and an insulation resistance of 4,440 megohms.

Our illustration, Fig. 2, for which we are indebted to *La Lumière Electrique*, shows the interior of a large sewer during the operation of suspending a cable. One of the large pipes shown carries the water of the River Seine, which is used for watering and sprinkling purposes, while the other brings in the water for household purposes. The small pipe is the pneumatic tube used for the transmission of messages, while the smaller one at its side transmits the air pressure for the large system of pneumatic clocks distributed all over Paris. One of the groups of cables represents the telegraph, the other (that which is being put up the telephone lines. We may add that this engraving was made from a photograph taken by electric light, so that it represents exactly the position of the various conduits, and is a good example of the varied uses of the electric current possible underground.

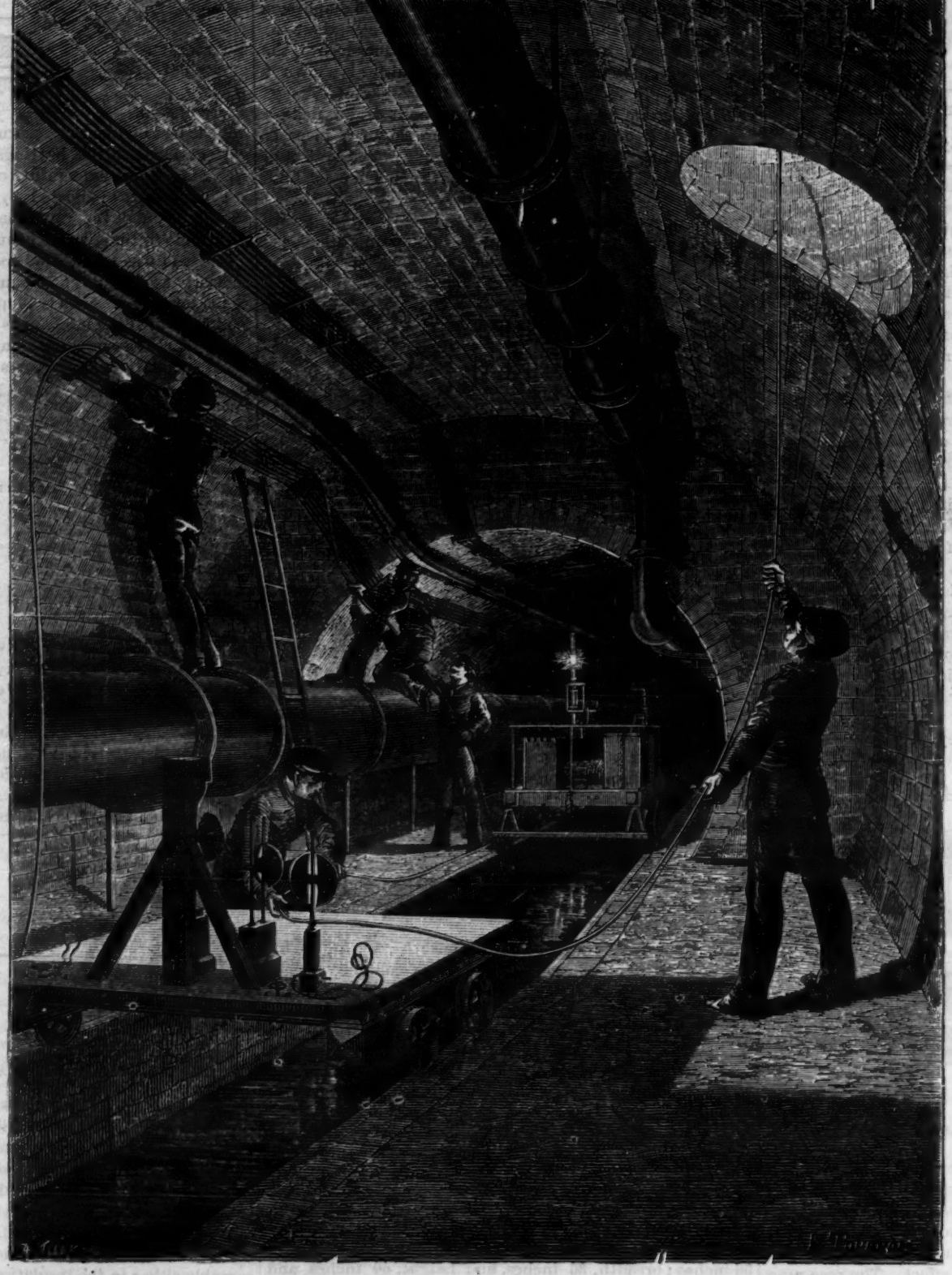


FIG. 2.—PUTTING TELEPHONE CABLES IN THE SEWERS OF PARIS.

A Russian Use of the Telephone.

"A police inspector at Odessa," says an English journal,

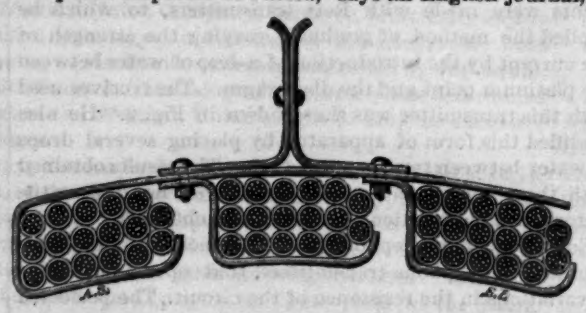


FIG. 1.—WALL BRACKET FOR HOLDING CABLES.

"the name of whom, Dorbrijinsky, deserves, in spite of its dissonance, to be mentioned on account of his cleverness, has discovered a new use for the telephone. One day recently a policeman brought to the station a Jew having in his possession a quantity of silver believed to be stolen. The silver was in a semi-molten condition, and had none of its original features remaining to assist in its identification. Hence, as the Jew stoutly declared the metal to be his own property, the police inspector was put in a fix, from which all his cross-examination of the supposed thief failed to extricate him. A happy expedient occurred to him. He went to the telephone in the adjoining room, and, mentioning to the officials at the police master's office what had happened, instructed them to utter in solemn tones, on a signal being given, the words, It's no use, Smeliansky, it will be better for thee to confess thou hast robbed somebody, otherwise the punishment will inevitably be more severe.'

"Afterward, summoning the Jew into the room, he pointed to the instrument on the wall, and told him that it did not matter whether he divulged his crime or not, as the 'machine' would do it for him. At this the Jew laughed outright, while the inspector laid a sheet of paper on the table and prepared to take down the confession. When everything was ready, he told the Jew to put the tube to his ear and decide whether he would confess himself or allow the 'machine' to do it for him. Then, giving the signal, he returned to the table, when a second or two later he had the satisfaction of seeing the Jew's face turn deadly pale at hearing the solemn advice mysteriously conveyed to him by the 'machine,' and of noting down directly afterward a penitent confession from the thief's own lips."

Underground Wires.

The report of the examiners on underground conduits exhibited at the Philadelphia Electrical Exhibition has been made. In presenting their report on underground conduits, the examiners take occasion to say at the outset that in no case was it possible to state from actual observation of the working of any of the systems, whether they did or did not fulfill what was claimed for them. Notwithstanding this, the report (which appears in full in the *Journal of the Franklin Institute* for February) is a valuable one, in so far as it brings to notice a collection of some of the means devised for leading electric circuits underground. The report embodying the description of about a dozen different systems, one of which we have given, affords a good idea of what has been attempted in that direction in our own country. Although the examiners abstained as far as possible from entering into the comparative merits of the systems, they have nevertheless noted the obvious distinctive features of value in each system, so far as they had means of judging. The committee also offer an opinion with regard to the future of electric conduits, which is of special interest in the light of the recent ordinances passed in various cities, regarding the disposition of wires. The report says:

"The rapid advance of electrical science in the past renders it nearly certain that the next few years will witness great changes in the methods for the production and distribution of this form of energy; and with an unelastic system in which a corporation may have expended large sums of money, the practical advantages of the introduction of electricity may be entirely dissipated for a long time. For the same reason it seems to the undersigned unadvisable at the present time for a corporation to adopt any style of plant which is adapted only to one system of distribution, however excellent the system may seem to be.

"They feel impelled to add one final word in view of the doubt that has been expressed as to the feasibility of constructing undergound conduits for all purposes of electrical distribution. Certainly, at least within the limits of large cities, whether or not it be found in the future to be desirable to inclose telephone and telegraph with light and power circuits, or any two of the foregoing in the same conduit, they express no opinion, but that the electric current for any and all of these purposes can be successfully transmitted underground, there is not the least reason to question.

"They believe that a careful series of tests, made by competent experts, on the systems already laid, would be of great value to science, and to all those who are interested in the use of the electric current."

It will be remembered that the intention is to mak reports, and not t award prizes or diplomas,

Edison's Telephonic Inventions.*

BY PROF. EDWIN J. HOUSTON.

It is a significant fact that, of the four men—Bell, Gray, Dolbear and Edison—who have had so much to do with the present condition of the articulating telephone, and whose labors have enabled it, to so great an extent, to occupy its present commercial position, three of them—Bell, Gray and Edison—were, for several years previous to its extensive introduction, engaged in active work on different systems of multiplex-harmonic telegraphy.

The several systems of multiple telegraphy thus developed, though differing in their details, are all dependent for their operation on the transmission, over the main line, of electrical impulses that are varied at the regularly recurring periods necessary for the reproduction of the pitch of the musical sounds transmitted. The electrical currents

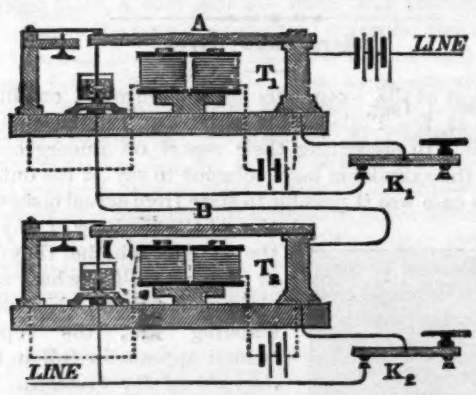


FIG. 1.—EDISON'S ACOUSTIC TELEGRAPH.

sent into the line are simultaneously varied in their intensity by the vibrations of reeds tuned to produce several notes of different pitch. On reaching the distant end of the line the currents, thus superposed on one another, are caused to impart a vibratory motion to tuned electro-magnetic receivers, whose rates of vibration correspond to the rates of vibration of the transmitting instruments. The receiving operator at the distant end of the line, having his instrument sensitive to the signal sent by his correspondent at the transmitting end, is thus unaffected by the signals that are being simultaneously transmitted by the other instruments.

With a knowledge of the results already achieved by Reis in articulate telephony, the mere fact of constantly dealing with such varied electrical currents was naturally enough followed by marked improvements in the articulating telephone.

Edison began his investigations in multiplex-harmonic telegraphy in September, 1875, when he constructed an arrangement whereby two tuning-forks of different rates of vibration were kept in constant motion by the action of an electro-magnet. A battery electrode, attached as a metallic point to one of the tines of each of the forks, dipped into a vessel containing acidulated water, and during the vibration of the fork, was moved towards and from the other electrode. Under the variations in the resistance thus effected, undulatory currents were sent over the main line. This form is shown in Fig. 1.

In this apparatus a local battery is provided for the vibration of the fork and its movable electrode. The

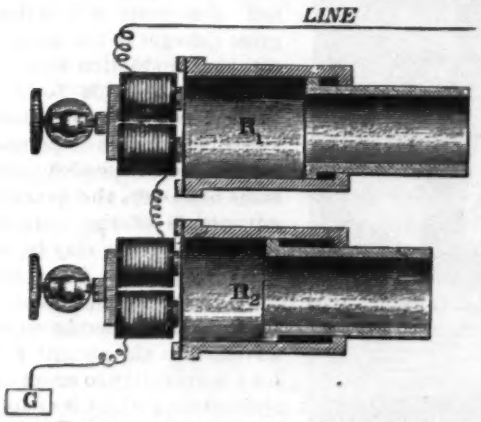


FIG. 2.—EDISON'S ACOUSTIC TELEGRAPH RECEIVER.

movements of this electrode in the liquid, towards and from the metallic point in the bottom of the vessel, vary the otherwise constant electric current in the main battery connected with the line, and thus send an undulatory current over the line. Keys K_1 and K_2 are used for signaling, by the short-circuiting they effect. The receiving apparatus for this device is shown in Fig. 2.

It consists essentially of the two electro-magnets connected to the main line. Opposite the poles of these magnets are placed two hollow vessels R_1 and R_2, to the ends of which are soldered iron diaphragms. Although the undulatory currents produced by both transmitting forks pass through the electro-magnets of each of the receivers R_1 and R_2, and therefore affect their diaphragms, yet the resonant column of air in each of the receivers, being tuned by means of a sliding or telescopic joint, to vibrate in unison with but one of the sounds, that sound only is heard, to the exclusion of the other. When, therefore, the transmitting keys are operated, the signals resulting on the starting or the stopping of the vibrations are heard

* Journal of the Franklin Institute, February, 1885.

in their appropriate receivers only, that sent by T_1 being repeated by R_1 only, and that sent by T_2, by R_2 only.

Mr. Edison's early inventions in telephony were mainly in the direction of transmitting instruments of the type that depend for their operation on variations produced by the voice in the electrical resistance of a battery circuit. Any form of electro-magnetic receiving telephone is suitable for use with such transmitters. His first experiments were made with Reis transmitters, to which he applied the method of gradually varying the strength of the current by the introduction of a drop of water between the platinum point and the diaphragm. The receiver used with this transmitter was that shown in Fig. 2. He also modified this form of apparatus by placing several drops of water between two metallic discs. The results obtained with these early forms of apparatus were not quite satisfactory, although articulate speech was obtained.

Edison's carbon telephone forms his most valuable contribution to telephone transmitters, that operate in virtue of variations in the resistance of the circuit. The perfected transmitter was the gradual outgrowth of a great number of what may be termed preparatory inventions. It will be of interest to notice some of these early forms of variable-resistance transmitters.

One of the earliest patented of such transmitters consisted of a number of contact springs, with resistances so included between them as to be short-circuited by the movements of the vibrating diaphragm. As the diaphragm vibrated under the influence of the sound waves these resistances were alternately cut out or introduced into the circuit of a battery. This form of transmitter is shown in section in Fig. 3.

The diagram *g* has interposed between it and a flexible conductor *D* an elastic cushion *f*, formed of a piece of rubber tube, fastened to the diaphragm. The object of this arrangement is to prevent the setting up of false vibrations.

A number of metallic springs e^1, e^2, etc., form the terminals of a series of resistance coils. These springs are placed

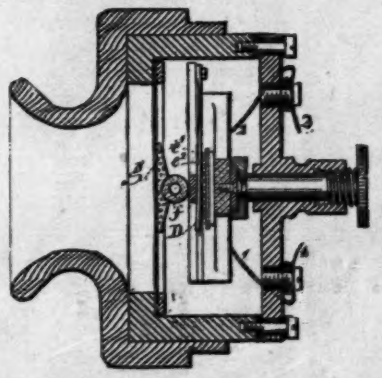


FIG. 3.—EDISON'S RHEOSTAT TRANSMITTER (SECTION).

contiguous to the flexible metallic strip *D*, so that when *D* is moved to and fro by the vibrations of the diaphragm it comes into contact with e^1 just a moment before it does with e^2 and so on. When *D* touches both e^1 and e^2 the resistance coil included between them is cut out, thus lessening the resistance of the battery circuit. On a more vigorous movement of the diaphragm, the flexible strip *D*, touching all the contact points, thus cuts all the resistance out of the battery circuit. The strength of the electric waves sent into the line is therefore proportional to the amplitude of the vibration of the diaphragm or to the loudness of the sound waves.

In Fig. 4 is seen a rear view of the diaphragm, showing the arrangement of the rheostat wires and the mode of winding the same.

Fig. 5 shows the circuit connections; h^1, h^2, h^3, h^4, h^5, etc., are resistances connected to the contact springs e^1, e^2, e^3, e^4, e^5, etc. An induction coil *A* formed, as shown, of the coils m^1 and m^2, has the ends of its secondary coil m^2 connected to the ground and the line. The primary wire m^1 is placed in the circuit of the battery *c* and the resistances h^1, h^2, h^3, h^4, h^5, etc. *B* is the receiving instrument, and B^1 its diaphragm armature.

[TO BE CONTINUED.]

A Dynamo's Long Run.

The dynamo is of the latest Edison-Hopkinson type, with a short armature. The exterior dimensions are: Length, 56 inches; breadth, 36 inches, and height, 60 inches, and the net weight of the machine complete is 32 cwt.

The commutator is of copper, with mica insulation, has forty bars, and is provided with double brushes independently adjustable. The magnets are shunt wound.

Magnet resistance is	7.54 ohms.
Armature "	0.009 "

The dynamo is designed for a continuous load of 250 ampères and 55 volts, and to run at a speed of 900 revolutions per minute.

The efficiency of the machine is deduced from the following figures:

	Watts.	H. P.
Total electrical power developed	16,246	21.78
Loss in magnets	401	0.54
Loss in armature	720	0.96
Power available in outer circuit when run as in test	15,125	20.28

Hence—

	Per cent.
Electrical efficiency	93.1
Loss in magnets	2.4
Loss in armatures	4.5

The following are the particulars of the test to which this machine has been subjected:

The dynamo was arranged for driving by an ordinary strap from a double cylinder engine made by Mather & Platt, and carried on slide rails, to admit of the belt being tightened if required. One of Sir William Thomson's graded potential galvanometers was permanently coupled to the machine to give a continuous indication of the electromotive force between the terminals, and arrangements were made for measuring the current by means of a current galvanometer, also of Sir William Thomson's graded type.

The temperatures of the bearings were measured through-

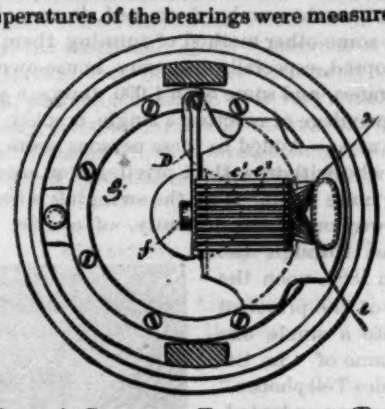


FIG. 4.—EDISON'S RHEOSTAT TRANSMITTER (REAR VIEW).

out the test by means of thermometers placed in mercury cups attached to the bearings, and a continuous record was kept of the temperature of the room.

The speed was indicated by a tachometer, attached to the engine, and the revolutions of the dynamo counted from time to time with a counter.

The load was maintained constant throughout the test, as nearly as possible at 275 ampères and 55 volts measured at the terminals. This is 10 per cent. above the normal load for which the machine is intended.

The machine was started on Dec. 30, and run for five hours, when the temperatures were taken as follows:

Room	17° C.	Magnets	33° C.
Pulley bearing	35° C.	Armature	76° C.
Commutator bearing	36° C.	Commutator	70° C.

At the end of twelve hours' run the temperatures were again taken.

Room	20° C.	Magnets	33° C.
Pulley bearing	36° C.	Armature	84° C.
Commutator bearing	34° C.	Commutator	75° C.

Again, at the end of twenty-four hours the temperatures were:

Room	15° C.	Magnets	33° C.
Pulley bearing	30° C.	Armature	76° C.
Commutator bearing	29° C.	Commutator	74° C.

Showing that at the end of twelve hours the maximum temperatures had been reached in all parts of the machine. Subsequently throughout the entire run of three weeks' duration the temperatures did not vary more than was accounted for by variations in the temperature of the room.

The speed maintained throughout the run varied from 910 revolutions to 925 revolutions, with the full load, and the armature and magnets warm.

The machine was run continuously, stopping 10 minutes

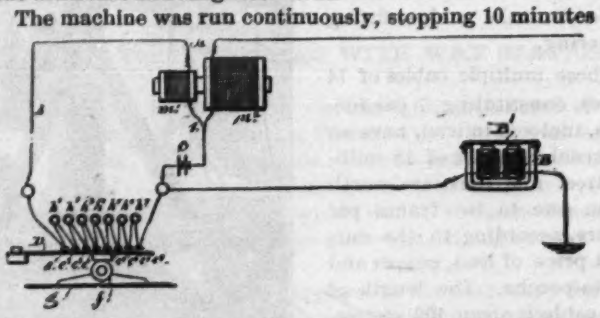


FIG. 5.—EDISON'S "SECONDARY" TELEPHONE CIRCUIT.

daily to read the temperatures of the armature and commutator, and for Sunday, until Jan. 6, when it was stopped in order to take out the armature and have it examined, to determine if there were any sign of charring or deterioration in the insulation of the wire; and in order carefully to examine the commutator. The examination was conducted by Mr. Blackburn, on behalf of the Edison and Swan United Company, and no change whatever was observable either in the insulation of the wires of the armature or in the commutator.

It was then decided to run the machine absolutely continuously for a fortnight without any break whatever, with the full load of 275 ampères. This test concluded on Jan. 20.

Throughout the whole of this continuous run for fourteen days there was never the slightest sparking at the commutator, the bearings and magnets remained at a uniform temperature throughout, and the temperature of the commutator at the end of the run was 79° C., practically the same temperature as at the end of twelve hours. One set of brushes were used without change of adjustment for twelve days, and at the end were found to be worn down uniformly one-sixteenth.

The commutator was perfectly smooth, and showed no

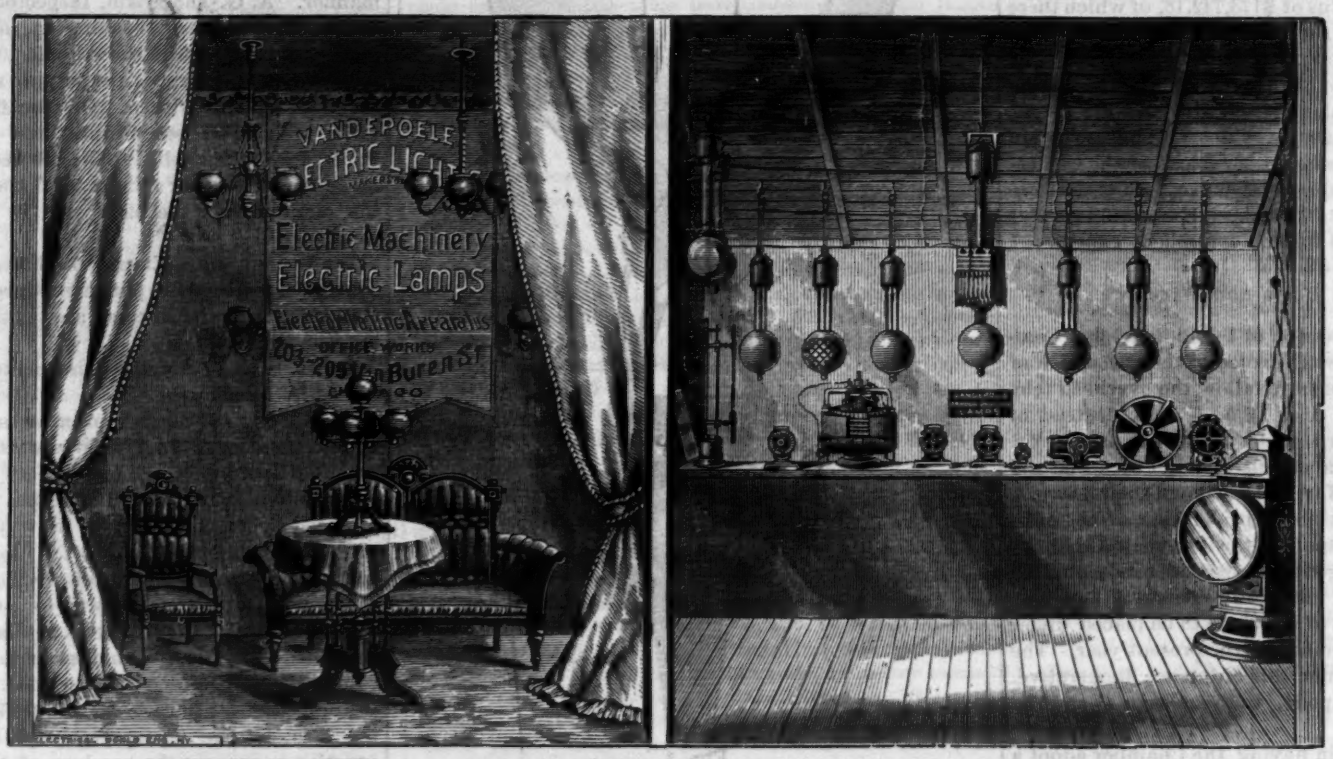
sign of wear or grooving, and the armature had stood the run without the slightest swelling or any sign whatever of change in the insulation.

These tests were undertaken by Mather & Platt, at the request of the Edison and Swan Company, in order to show the durability of the Edison-Hopkinson dynamo under a long and continuous strain, with a load 10 per cent. in excess of that for which the machine is sold. The conditions of the test were formulated by Mr. Albright and Mr. Blackburn on behalf of the Edison and Swan Company, and it was superintended by them and their representative, Mr. Creagh, during the entire run.

It proved conclusively that a dynamo of this type may be run continuously, without any change in its working parts or deterioration in the insulation of the copper conductors, or change in their resistance, and that the wear is exclusively confined to the commutator and copper brushes, and that, with regard to the former, three weeks' run is not sufficient to produce any visible wear, and that the brushes last much longer than usually supposed, one set being capable of lasting a year on a machine running on an average three hours a day.

The Van Depoele Exhibit at Philadelphia.

We illustrate on this page a part of the fine exhibit made by the Van Depoele Electric Manufacturing Company at the International Exhibition, last September and October. Many of our readers will remember it as occupying some of the large alcoves in the North Gallery, the large dynamos being in position on the main floor below. Prior to the Exhibition, the company had not courted much publicity in the East, but had confined its operations to the West and Northwest, where it enjoyed considerable popularity. Since that time, however, it has extended its reputation and has become very well known among electric lighting men and to electricians generally.



THE VAN DEPOELE GALLERY EXHIBIT AT THE ELECTRICAL EXHIBITION.

The exhibit included one 60-light, one 20-light and one 12-light machine. There were two electro-plating machines, an eight horse-power generator for electric motors, seven motors ranging from one-hundredth of a horse-power up to ten horse-power and thirty-six sewing-machine motors. To this class of apparatus belonged also the induction machine for distributing currents for incandescent and other lights. In the lamp class were the arc lamps for street, store and factory lighting. One of these lamps has no rod, the carbon being held in place and fed by an endless copper belt, which in turn is actuated by a small electric motor of simple construction placed in the top of the lamp. This lamp can be placed horizontally or turned upside down without in the least affecting the proper feeding of the same, and carbons 24 inches long can be used if necessary for protracted running. There were shown also two focusing lamps for steamboats. The main features of the dynamos and lamps were illustrated and described by us on Sept. 27, 1884.

As will be seen from our illustration, part of the gallery exhibit was fitted up elaborately as a room, with hangings and furniture, over all of which the Van Depoele lamps shed their light every night with much satisfaction to the numerous visitors. The effect was extremely tasteful and pleasing, the softness of the light reconciling the eye to the use of the arc lamp in a space so limited.

The Bell Telephone in Canada.—A dispatch of Feb. 14, from Montreal, says: The Bell Telephone Company of Canada is out with a notification to the public that proceedings are now pending for the purpose of having the recent decision of the Commissioner of Patents voiding their patent set aside as inoperative. No battery transmitter can be made without infringing on one or the other of the company's numerous patents, and proceedings will be taken to prevent any infringements.

The Western Union and the Railroads.

Most of the Western railroads which have been benefited by land-grant subsidies from the government own and operate their own telegraph lines. There is a clause in each subsidy grant which prohibits the railroad company receiving such grant from giving to any other corporation or telegraph company exclusive telegraphic privileges. The Western Union Company, however, practically enjoys exclusive privileges in the use of the telegraphic lines belonging to the Pacific railroads controlled by Jay Gould. The Baltimore & Ohio Telegraph Company has determined to contest the Western Union's right to keep its exclusive privileges.

An application by letter was made by President D. H. Bates, of the Baltimore & Ohio Company, to the Union Pacific Railroad last August, asking for an exchange of telegraphic business at Kansas City with the Kansas Pacific and the Union Pacific Railroad telegraph lines. Mr. Bates said that he desired to open up those lines to the public through the Baltimore & Ohio as a competing line with the Western Union. He took the ground that the various acts incorporating the Union Pacific and the Kansas Pacific companies, and extending to them government aid, contemplated the operation of the entire telegraph system of those roads free of discrimination of every kind. It is the desire of the Baltimore & Ohio Company to connect its own lines with the telegraph lines of the Union Pacific, Kansas Pacific, Missouri Pacific, Northern Pacific, and the Atchison, Topeka & Santa Fé railroads. Such connections would give to the Baltimore & Ohio the same facilities for reaching the Pacific coast as are now enjoyed by the Western Union Company.

More than a dozen letters have passed between President Bates and Charles Francis Adams, Jr., president of the Union Pacific Railroad. After Mr. Bates had repeatedly requested a definite answer to the application of the Baltimore & Ohio Company, Mr. Adams replied as follows, on Jan. 5:

"Our company will at any place where it has an office for commercial telegraph business receive from any person or corporation, including the corporation represented by you, any message offered to it, and transmit the same without discrimination of any kind, at the same rates and on the same terms as it does messages from any other person or corporation. I have not at hand the tariff of rates, but such tariff can be obtained by your company at any of our company's offices where it does telegraph business for the public. * * * This company will not make any contract in respect of a general interchange of business involving the keeping of accounts for the business so exchanged."

President Bates wrote that such terms would be perfectly satisfactory to the Baltimore & Ohio Company, and in order that the necessary arrangements might be completed he requested Mr. Adams to send him a list of the telegraphic stations on the line of the Kansas Pacific road between Kansas City and Denver. There are said to be about 60 of those stations. After some delay Mr. Adams replied that there was no list of the stations kept by the company, but that the stations were "well known." Thus the matter stands after five months of correspondence. The officers of the Baltimore & Ohio Company suspect that the strong Western Union influence in the Union Pacific directory is accountable for the disinclination of the officers of the Union Pacific to enter into the arrangement proposed by the Baltimore & Ohio Telegraph Company.

The American Union Telegraph Company made a similar demand upon the Union Pacific Company about five years ago, when Mr. Gould was connected with the American Union. Ex-Judge Dillon, who was counsel for both the Western Union and the Union Pacific companies, prepared an opinion, together with Sidney Bartlett, of Boston, setting forth that the Union Pacific Company was obliged under its charter to extend its telegraphic facilities to the public through any and all mediums without discrimination. The consolidation of the Western Union and the American Union soon followed.

Electric Lighting as a Paying Business.

At the moment of going to press we are in receipt of the report of the executive committee of the American Electric and Illuminating Company to the Board of Directors. The report is full of interesting and important information, and the figures it gives are highly creditable to the management. The acquisition of an interest in the Boulton Carbon Company, and the alliance concluded with the Edison Company, are both referred to as steps likely to result most favorably. In regard to the Merchants' Electric Light and Power Company of Boston, and the difficulties it encountered, it is explained that these arose from the inability of its officers to place the treasury stock to meet the heavy obligations incurred in building its new central lighting station. The parent company immediately came to the rescue, and assumed the management of the Merchants', reduced expenses to a minimum, used the earnings of the company to pay off the debt as rapidly as possible, and used its own resources, until at the present time the original debt of $80,000 has been reduced to a floating debt of $4,000. An analysis is given of the business done by the company in Boston which, it will be seen at a glance, has been a most profitable one. The Merchants' Company is now on a sound, dividend-paying basis, and there seems no reason why, with the natural increase of business, it should not hereafter easily pay regular 8 per cent. dividends.

The progress of the American Company during the two and a half years of its existence, and its present good standing, are evidenced in the subjoined financial exhibit:

ASSETS.		
Stock in sub-companies, *all of which are on a dividend-earning basis*		$419,857.27
Cash due from sub-companies		98,115.61
Mortgages and real estate		38,498.09
Merchandise, consisting of machinery and building materials		15,000.00
Open accounts due the company		8,609.61
Office furniture, head office and sub-companies		3,000.00
Cash on hand		4,182.04
		$587,262.62
LIABILITIES.		
Bills payable	$4,009.66	
Due on Canada business	10,000.00	
Due on construction work, sub-companies, to date	25,879.67	
Capital stock preferred	447,030.00	
		486,919.33
Surplus		$100,343.29
Balance of treasury stock unsold	$302,770.00	
Dividends paid to date	$88,000.00	

It is proposed that, in view of the demands for new construction work, and in order to get building material at low prices for cash, the dividend declared March 1 be scrip, instead of cash, making the scrip payable Jan. 1, 1886, with interest. Thus the cash in hand will be immediately available for contemplated extensions.

Reducing Rates.—The Bankers & Merchants' Telegraph Company made on Monday last a reduction in rates from New York to the following points, from 25c. for 10 words to 25c. for 20 words, and 1c. for each additional word: Chicago, Buffalo, Springfield, Washington, Baltimore, St. Louis, Oil City, Toledo, Philadelphia, Cleveland and Pittsburgh.

Purchase of the B. & M. by the Postal.

The receivers of the Bankers & Merchants' Telegraph Company have been negotiating during the past few days with capitalists interested in the Postal Telegraph Company. It was stated on the 16th, by one of the receivers, that the negotiations had not been concluded, but there was a general understanding among telegraph men that the Postal Telegraph capitalists had agreed to advance the receivers of the Bankers & Merchants' all the money they needed, and in consideration therefor the lines of the Bankers & Merchants' Company would be placed at the exclusive disposal of the Postal. The scheme provides that receivers' certificates shall be issued for whatever sums of money are advanced.

The receivers of the embarrassed telegraph company say that they are making satisfactory progress in straightening out the company's tangled affairs. They have redeemed $3,000,000 of the bonds and are arranging to redeem $2,000,000 more, which will leave but $5,000,000 of bonded debt. The receivers have also redeemed 4,700 shares of the stock of the Commercial Telegram Company, which is worth about $200,000.

Mexican Telegraph Company.

The annual report of the Mexican Telegraph Company for 1884 shows these interesting facts:

	1884.	1883.	1882.
Receipts	$228,804	$233,403	$152,702
Expenses	69,896	61,582	63,391
Dividends	114,752	95,544	91,530
Surplus	44,156	76,276	53,309

Since the line was opened, March 3, 1881, the company has earned $700,459.30, expended $224,890.44, distributed $301,826.68, leaving a surplus of $173,742.18, of which there has been applied to construction and investment $109,078.90, leaving a net revenue, Dec. 31, of $64,663.28. The estimated net revenue, Jan. 31, 1885, was $75,663.28; February dividend, $57,376; surplus beyond dividend, $18,287.28. The capital stock is $1,500,000, of which 656 shares remain in the treasury. It has, besides, 1,362 shares of the Central & South American Telegraph Company, which cost $127,450, making the stock assets $193,050. The annual surplus is expected to prove ample for any contingent expense.

Philadelphia Poles and Wires.

The greater part of the session of the Philadelphia Common Council, on Feb. 12, was devoted to the discussion of the ordinance which proposed to allow the overhead telegraph wires to remain until Jan. 1, 1886, instead of causing them to be placed under ground at once. Mr. Maloney fought the ordinance bitterly, and held that the companies had made no effort to take down their wires.

Mr. Murphy moved that the consideration of the ordinance be indefinitely postponed, for the reason that the Legislature was now engaged in the consideration of a bill which, if adopted, would cause all telegraph and telephone wires in the cities of the State to be placed under ground by the 1st of December of the present year. The legislative bill would render this ordinance inoperative. Upon the motion to postpone, the yeas were 41 and the nays 26.

Captain Ford succeeded in having the Chamber adopt a resolution instructing the city solicitor to proceed at once to enforce the ordinance of 1882, which provides a penalty of $50 per day for each pole remaining with wires suspended upon it after Jan. 1, 1885. There are 4,640 poles in the city.

The Gerritt Smith Duplex.

To the Editor of the Electrical World:

SIR: Having been out of the city almost constantly for the past six weeks, I have not been able to reply to the friendly criticisms of my friends Messrs. Terry and Finn, of my review of their work, "Illustrations and Descriptions of Telegraphic Apparatus." The gentlemen take exception to my opinion of the title of plate xiv., namely, "Polar duplex with battery at one station," which, I stated, was hardly correct, inasmuch as it was as much a Stearns duplex as a polar duplex. My friendly critics take the ground that whatever the duplex in question may be, it is not a Stearns duplex; and, secondly, that it has all the instruments necessary for a polar duplex, and that it has none of the instruments of a Stearns duplex, therefore it is more of a polar duplex than a Stearns duplex. In the first place, let us understand what is meant by the Stearns duplex. By general consent it is that class of duplex telegraphy which is operated by the increase and decrease of strength of current, and, consequently, it matters not whether the variations in strength are caused by the interposition of resistance or by taking off a portion of the battery.

In support of this view, I beg to refer the gentlemen to plate xv. of their own work, which shows a Stearns duplex with battery, at one station only. Now, then, in plate xiv. there is an arrangement to increase or decrease the strength of current by inserting or taking out resistance, which I claim makes it in part a Stearns duplex. Further, if it were a *polar duplex*, there should be two pole-changers and two polar relays, whereas plate xiv. only shows one pole-changer and one polar relay, but it also shows one transmitter and one neutral relay, the latter two instruments being part of a Stearns duplex.

Why not have called this ingenious hybrid duplex after its inventor, the "Gerritt Smith duplex," by which name it is well known? REVIEWER.

The Oppermann System of Incandescent Lighting.

In our issue of Sept. 4, 1884, we described and illustrated the various dynamos of Messrs. Oppermann Bros., among them being one for alternating currents, which received the bronze medal at the International Health Exhibition held in London last year. We add to this some details of their incandescent system, which has been recently improved. The 100-light incandescent machine claims attention on account of the smallness of its armature, which is said to weigh only 6 pounds, the total length of the wire being 100 feet. In its construction, no iron whatever is employed, by which means the Foucault currents are avoided. The commutator, or more correctly the collector, is a single solid ring of copper without cross-cuttings, and as there is no make and break of current, no sparks appear and the collector can be lubricated, while the formation of copper dust is avoided. This machine when run at 1,200 revolutions per minute, gives an E. M. F. of 50 volts and a current of 130 ampères.

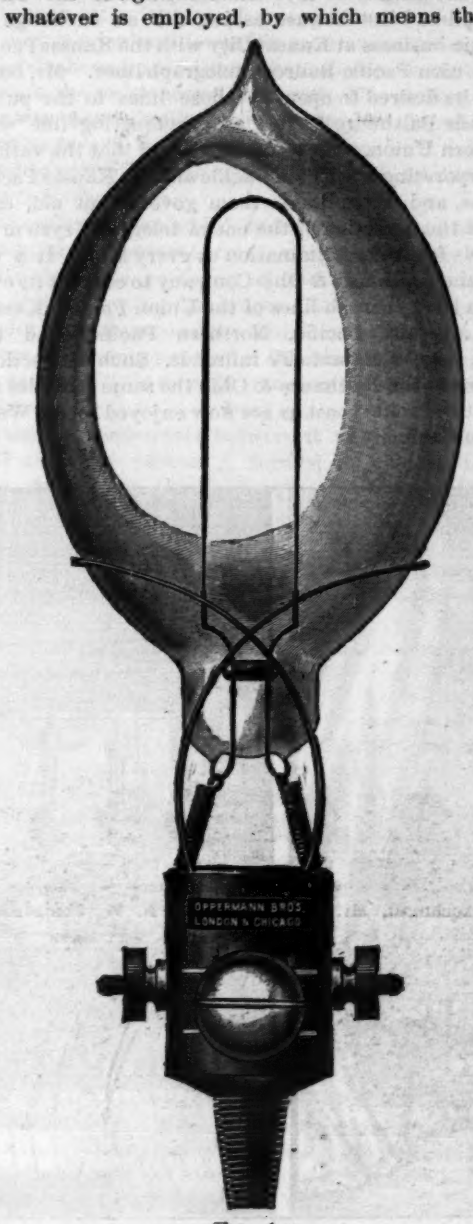


FIG. 1.

The incandescent lamps of the Oppermann system are

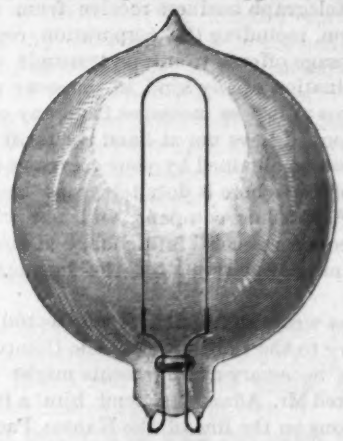


FIG. 2.

represented in Figs. 1 and 2, and they range from 2½ to 20 candle-power. Fig. 1 shows the 20-candle lamp in one of the patent "off and on" holders, which can be screwed into existing gas fixtures or into walls, and are very handy for experimental purposes and trial installations. Fig. 2 represents the 8 candle-power lamp. Besides these, 50 and 100 candle-power lamps are now being made which will be put on the market shortly. The firm also build machines for the electro-deposition and refining of metals and for the charging of accumulators; their silver-plating machines, especially, have met with good success. The firm are now running large works at Chicago, in addition to their works in England.

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, Feb. 19, 1885.

The great storm which struck Chicago at about 8 o'clock on the night of the 8th, and continued without abatement for nearly twenty-four hours, did very little damage to the telegraph lines in this vicinity, owing to the fact that the snow-fall was a comparatively dry one. The Western Union wires were all working fairly on the 9th, and at that time there were no reports of any wires having been blown down. The Postal people reported their lines as all right, although not working quite as rapidly as usual. The Baltimore & Ohio and Bankers & Merchants' wires were in very good order. There was no serious detention. Further south, however, the storm partook more of the character of sleet, and was accompanied by thunder and lightning. At Dwight, Ill., the electric disturbances were so great that connection with the instruments had to be broken. Though the greatest storm of the season, the telegraph and telephone people suffered very little annoyance compared with that which the recent sleet storm caused them.

Chicago is talking of elevated railroads, and the property owners on State street on the South side, and Van Buren and Twelfth streets and Blue Island avenue on the West side, will probably soon be asked to consent to the introduction of the system on those thoroughfares. I have it from one gentleman that electric motors are to be used to propel the trains.

There has been comment to the effect that the engines in the government building here were not of sufficient capacity to run the electric light plant in a satisfactory manner. A. G. Thompson, Inspector of Public Buildings, and P. W. Dwyer, of Washington, made an official examination of the plant on the 9th and 10th. The engines are built to run 280 strokes per minute as a maximum when the entire plant is used. On the first day the engines made 240 strokes per minute, and the entire number of lights, 780, were applied. On the second day the engine made 280 strokes per minute, and the examiner expressed the opinion that the plant was in every way satisfactory.

The United States Electric Lighting Company have just concluded contracts to put incandescent plants in the new Malleve Building, Chicago, and in the Post-Office Building, Cincinnati.

Mansfield and Hartville, Missouri towns, are being connected by telephone.

Conversation is carried on in an ordinary tone of voice by telephone between Toledo and Ionia. The towns are 200 miles apart.

A resident of Chester, Ill., comes to the front with a patented electric bell-cord for railway or street cars.

Crawfordsville, Ind., wants the electric light. The local gas company was recently defeated in its efforts to have its contract with the city renewed for a term of five years.

Recent tests of the Gillette long-distance telephone have been made with what would seem to be somewhat better results than those formerly obtained.

Application was made to Judge Gresham, in Chicago, the 13th, by the Postal Telegraph Company for an injunction to prevent the receiver of the Bankers & Merchants' Telegraph Company from cutting the wires of the former company. The petition shows that by an arrangement between the two companies they laid a large quantity of their wires in the city underground in the same conduits, each bearing half the expense. It is claimed, however, that by this arrangement the portion of the iron pipe in which were the wires laid by either company was to belong to that company. When the receiver of the Bankers & Merchants' Company took possession of its effects, he claimed the underground pipe belonging to his company, and cut the Postal Company's wires at the corner of Clark and Jackson streets. The petition is to restrain them from further damaging the wires and arguments upon it will be heard on Feb. 23.

"Telephone" the Same as "Telegraph."

At Harrisburg, Pa., on the 5th inst., Judge Simonton filed an opinion in the appeal of the Pennsylvania Telephone Company from the settlement of the Auditor General and State Treasurer, giving judgment for the commonwealth for $345.04, the amount claimed. The tax was based on the report of the company showing its gross receipts for the six months ending June 30, 1883, to be $35,794.91, and under the provisions of the act of June 7, 1879, which imposes a tax upon the gross receipts of "every telegraph company" incorporated under the laws of this or any other State and doing business in this commonwealth. The question to be decided by the court was whether the appellant is a telegraph company within the meaning of this act. The court reviews the subject at length, and in conclusion holds "both on the construction of the act under which the appellant is incorporated in connection with the taxing act, and on general principles, that appellant is a telegraph company, and as such taxable on its gross receipts."

Hartford, Conn.—The Hartford Electric Light Company has declared a dividend of 1½ per cent., payable March 10. The company has 225 lights in use, and will increase them to 300. It claims to be earning 10 per cent.

THE TELEGRAPH.

Commercial Cables.—The loop of the Commercial Cable between England and France has been completed.

The Signal Service.—At the World's Fair Cotton Convention, held at New Orleans on Feb. 14, a resolution was passed inviting Congress to increase the utility and efficiency of the Signal Service.

Was It the Telegraph?—The telegraph makes horrible work sometimes. The name of William Penn Whitehouse, just reappointed by Gov. Robie as Judge of the Superior Court of Kennebec County, appears in a Boston paper as William Plobitshouse.—*Portland (Me.) Press.*

The "Mackay-Bennett" Steamer.—A dispatch of Feb. 17 from London says: The Commercial Cable Company's new repairing steamer, the "Mackay-Bennett," passed Dover this evening for Halifax, where she will have her headquarters pending her services in repairing any damage that may happen to the cables.

Stock Exchange Tickers.—The Stock Exchange has not renewed its contract with the Gold and Stock Telegraph Company, and negotiations are pending between that company and the Mining Board. Members of the Mining Board desire an exclusive contract with the Gold and Stock Company, and they declare that if such a contract is made it will be transferable to a consolidated exchange, and that the consolidated exchange will make its own quotations independent of the Stock Exchange.

A "Ticker" Injunction in Brooklyn.—A temporary injunction against the Gold and Stock, Western Union, Commercial and Bankers and Merchants' telegraph companies, in an action brought against them by the New York Mining Stock and National Petroleum Exchange, to enjoin them from discontinuing or interfering with the quotations of stocks furnished by them, was granted on Feb. 8 by Judge Cullen, in Brooklyn.

Communicating with Trains in Motion.—Thomas A. Edison, Sigmund Bergmann and Charles Batchelor are the incorporators of the Railway Telegraph and Telephone Company, whose certificate of incorporation was filed in the County Clerk's office on Feb. 18. The company is to purchase and use or license others to use patents, mechanical contrivances, etc., relating to the application of electricity to telegraphy and telephony generally and more particularly to telegraphing and telephoning between railway trains in motion and stations and moving trains. Its capital stock is $1,000,000, divided into shares of $100. The incorporators, with Ezra T. Gilliland, John C. Tomlinson, Samuel Insull and William Wiley Smith, are to be its trustees for the first year.

Bucket Shops in Canada.—The Montreal *Witness* gives the following case: An action has just been entered by Mr. W. S. Walker in the Superior Court, on behalf of Mr. A. N. Shewan, to recover the proceeds of a loan made by him some time ago. According to Mr. Walker's statement, some time since the party who obtained the loan went to Mr. Shewan and asked him for the money, advancing a note on one of the banks. Mr. Shewan afterward discovered that the note was worthless, and, learning that the party in question had been in the habit of speculating in a well-known bucket shop, Mr. Walker proceeded to take out a seizure, but says that he was confronted by the proprietors, who claimed that they owed nothing, as the names of all parties doing business with them were unknown to them, and that they were only acquainted with their initials. Mr. Walker thereupon took out a seizure in the Superior Court to recover the amount, and the case will come up for evidence.

THE TELEPHONE.

Liverpool, England.—Another Western Electric multiple switch-board is being put in the telephone exchange.

Erie Instruments.—Erie put out 169 instruments in December and took in 323, making a net loss for the month of 154 sets, and leaving the number in use Dec. 31 at 8,999.

A Large Sum Invested.—It is said that the amount of the investments of Lowell, Mass., people in the Erie and the New England telephone companies is not less than $3,000,000.

A Cut in Operators' Wages.—The St. Paul *Dispatch* heralds an approaching cut in the wages of St. Paul and Minneapolis telephone employés. It is to take place March 1, and amounts, according to the *Dispatch*, to 15 or 20 per cent. The Minneapolis *Journal* hears that a new telephone company is to be organized in that city, and it promises, as usual, better instruments, and at a cheaper price.

The Union Telephone Company's Earnings.—The Union Telephone Company of New York State is earning a few hundred dollars net per month, which it applies to the floating debt. The debt is not large, but some months will be required to cancel it. The company labors under the disadvantage of having to pay full price, $20, for the rental of instruments, while the regular tariff is $20 less 30 per cent. It pays the extra by virtue of having a sub-contract from the Albany Company.

A Preliminary Injunction.—On the 14th inst. a preliminary injunction was granted by Judge Wallace in New York against the McDonough Telephone Company and the United States Telephone Manufacturing Company, restraining them from the manufacture and use of telephones under the McDonough patents until a hearing can be had upon the merits of the case, which is expected to be the last of the present month. The United States Company controls the McDonough patents.

The Beauty of the Telephone.—Brown (who has just had telephonic connection established between his office and house, and is very much pleased with it)—I tell you, Smith, this telephone business is a wonderful thing. I want you to dine with me this evening, and I will notify Mrs. Brown to expect you. (Speaking through the telephone)—My friend Smith will dine with us this evening. Now listen and hear how distinctly her reply will come back. Mrs. Brown's reply (coming back with startling distinctness)—Ask your friend Smith if he thinks we keep a hotel.

Telephone Handles.—A dispatch of Feb. 14 from Montreal says: The customs authorities here have seized a large number of handles for telephones, imported from the United States, for undervaluation. The seizure affects about one thousand instruments at the telephone company's works, and in fact involves all the instruments imported into Canada since the establishment of the company here. The handles were entered at 78 cents each, while the authorities claim that they should have been entered at $5. The company will appeal to the government at Ottawa.

New Telephone Companies.—The Atlas Telephone and Telegraph Company has been incorporated by James Hood, Rufus W. Leavitt and John Weaver. Its capital stock is $10,000,000, divided into 100,000 shares of $100 each. Frederick H. Smith, Jr., and George H. Dunham are its trustees, with the incorporators. The same persons are the incorporators and trustees of the Electric and Telephonic Underground Conduit Company, which was also incorporated on Feb. 18 by a certificate filed in the County Clerk's office, and whose capital is $1,000,000, divided into 10,000 shares.

Circuits in New England.—The New England Company will on March 1 bring all of the subscribers within a distance of 15 miles of Boston, excepting Lynn and points in Essex County, within a common suburban circuit, whereby they can communicate one with the other, the consideration to be an additional rental of $4 per year, and this in lieu of the present charge of 10 cents per message. The change has met with some objection, while others approve it. The subject of regulating telephone charges and kindred topics are now before the Legislature, and came up for a preliminary hearing recently. They will be further considered next week.

A Change of Occupation.—It gives us great pleasure to state that Mr. Peter W. Brown has accepted the position of agent for the New York & Hudson Steamboat Company in this city. It is a source of gratification to Mr. Brown, and his friends as well, to know that the position came to him unsought—a genuine case of the "office seeking the man." The company is to be congratulated upon having secured the services of this gentleman, in whom will be found all the qualities that are desirable in a young man, and we are sure the company will have no occasion to regret the choice made. Mr. Brown has been connected with the Hudson River Telephone Company, of this city, from the time of its inception up to within a few weeks, and made hosts of friends by his courteous, obliging and business-like way of conducting the affairs of that company in the different capacities in which he served, all of whom will be glad to hear of his good fortune.—*Hudson (N. Y.) Republican.*

Telephone-cum-Telegraph.—The Toronto *Globe* of the 13th says: Yesterday afternoon at about six o'clock a test was made at the office of the G. N. W. Telegraph Company, in this city, of the recent invention of Dr. A. M. Rosebrugh and Mr. G. Black, of Hamilton, by means of which telephonic and telegraphic messages can be exchanged through long distances on the same wire simultaneously. A member of the *Globe* staff held a conversation with the *Globe* correspondent in Hamilton, the voice of the one being distinctly recognizable by the other even when dropped to a whisper that was inaudible to a person a few feet away from the whisperer. While the telephone messages were being exchanged, Mr. Toye, of the G. N. W. Company, sent from his end of the same line a telegraphic message, which was immediately repeated by telephone from the Hamilton end. The main virtue of the invention consists in the entire suppression of the induction, which is such a nuisance on the ordinary telephone. For instance, everybody who has occasion to use the telephone in Toronto after nightfall knows that the noise caused by induction from the electric light wires is such, on wet nights especially, as almost to render conversation inaudible. Dr. Rosebrugh illustrated his invention by disconnecting the telephone instrument for a few moments from the appliance which suppresses the induction. Straightway the familar buzz of the Electric Light Company's dynamo was heard. Restoring the connection, the noise from the dynamo ceased to trouble. When the telegraphic signals were being sent over the line there was no inconvenience whatever felt by the listeners. The wire used for the test was one which passes from the G. N. W. Telegraph Company's office, up Church street and Queen along through a perfect maze of telegraph wires, and for two miles on the same poles with the electric light wires.

THE ELECTRIC LIGHT.

Guadalajara, Mexico, has just inaugurated its system of electric lighting.

Owensboro, Ky.—The local electric light company has begun operations, and the local papers are in raptures over the beauty and brilliancy of the light.

Hell Gate Lights.—It is said that the late severe weather has interfered considerably with the regular working of the lights at Hell Gate. The trouble is not with the lights but with the mechanical arrangements for getting at them. The elevator car is often unworkable.

The Thomson-Houston Company have closed a contract to furnish Freeport, Ill., with 15 arc lights. This just doubles their plant there. A 10-light machine goes to Pontiac, making their plant there consist of 35 lights, and a 50-light arc plant has just been sold at Janesville, Wis.

Owego, N. Y.—The Lamp and Watch Committee of the Owego, N. Y., Board of Trustees, have been authorized to make a contract with the Electric Light Company of Owego to light the streets of the village by electricity, for one year from about May 1, 1885, with not less than thirty electric lights of 2,000 candle-power each, for twenty nights in each calendar month, at a sum not to exceed $3,000 for the year. The dynamos are to be driven by the water-power that runs a grist-mill in the daytime.

Mayor Timken's Veto.—In one of our recent issues there appeared a note to the effect that Mayor Timken, of Hoboken, N. J., had seen fit to veto the proposition for lighting the city by electricity. It is but fair to explain that this veto referred to the granting of a franchise to a lighting company whose interests are identical with those of the gas company of the place. Besides this, the company wished the city to enter into a contract said to be disadvantageous to the latter, and hence the veto. We may add that an electric-light franchise has already been granted to parties who are now pushing the work of obtaining subscribers and erecting the plant.

Train Lighting in Germany.—Train lighting by electricity has been undertaken in Germany, where some trains on the Frankfort-Fulda-Elm line are now fitted up with a dynamo placed in the baggage car on one side and accumulators on the other side. The dynamo, if driven at 750 revolutions, gives a current of 12 ampères, which by an automatic switch is sent into the accumulators. Since the dynamo is driven from one of the axles of the van, it can only charge when the train is in motion and going at a speed of over twenty miles an hour. If the speed falls below this minimum, the switch cuts the dynamo off from the accumulators in daytime and from the lamps at night, since during the evening the lamps are fed direct from the machine so long as the train is in motion. On stopping, the automatic switch not only cuts the dynamo out, but also puts the accumulators in, thus insuring the continuation of the light at all times. The cost of installing the plant is given at £125 for dynamo, driving gear, and accumulators, and at 65s. to 80s. per passenger coach. The light itself is estimated to cost .85 of a penny per lamp-hour.

MISCELLANEOUS NOTES.

Artificial Gutta-Percha.—This substance is made in the following manner: 50 kilogrammes (110 pounds) of powdered copal, with from 8 to 15 kilogrammes (17½ to 33 pounds) flowers of sulphur, are raised to a temperature between 126° and 158° C. (259° and 316° F.) with double the weight of turpentine, or with 50 to 60 litres (11 to 13 gallons) of paraffin, being constantly agitated until completely dissolved. To this are added 8 kilogrammes (17½ pounds) of caseine dissolved in weak ammonia mixed with a small quantity of alcohol and wood spirit; and the whole is allowed to cool down to 38° C. (100° F.), being again heated to a temperature of from 126° to 158° C. (259° to 316° F.) until it has the appearance of a light liquid. It is then boiled with a solution containing from 15 to 25 per cent. of tannic acid and 500 grammes (1.1 pounds) of ammonia. It is kept boiling for several hours, allowed to cool, washed with cold water and then kneaded in warm water, when it is dried so as to be ready for use.

Globular Lightning.—Gaston Planté described, some years ago, under the name of "Walking electric spark," a peculiar phenomenon produced by the passage of an electric current of high tension. The appearances are so analogous to those of globular lightning, that he considers that phenomenon as a slow and partial discharge of the electricity from storm clouds, when that electricity is exceptionally abundant, and when the cloud itself, or the column of strongly electrified damp air, which forms its electrode, so to speak, almost reaches the ground, or is only separated from it by a thin layer of insulating air. Under these circumstances the ponderable matter which is traversed by the electric current collects under the form of a globe of fire. It is a kind of electric egg, without a glass envelope, which is formed by the rarefied and incandescent elements of air and vapor. The globe is not fulminating and dangerous by itself, for a breath is often sufficient to displace it or even cause it momentarily to disappear. Its presence, however, is formidable, for it brings the electricity from the storm cloud and reveals the chosen path of its escape. If the layer of air which separates the cloud from the ground is not traversed, the globe of fire may disappear without report. If a portion of the storm cloud approaches the earth or another conductor, the lightning may strike at a distance at the same moment that the globe disappears. If the layer of air is pierced, there is a flash of lightning accompanied by thunder, which is not due to the small quantity of electricity inclosed in the globe, but to the sudden discharge of a large portion of the electricity of the cloud.—*Comptes Rendus.*

Keeping the Church Warm.—The New York correspondent of a Chicago paper says: One of our wealthiest congregations, that of the well-known Dr. Paxton's church, on Forty-second street, near Fifth avenue, and opposite Bryant Park, worshiped last Sunday under peculiar circumstances. As the members entered they saw protruding from the front of two pews on either side of the pulpit, what looked like the muzzles of two brass cannons. On closer inspection, however, they proved to be telemeters, instruments used extensively in cold storage warehouses, for indicating and recording the temperature in the storage vaults in the manager's office, the record being transmitted from point to point by a delicate electrical appliance. Happening to have attended church to hear Dr. Paxton, I inquired after service why these instruments had been put in. I was informed that while during the past summer $60,000 had been spent in decorating the church and supplying it with the latest improvements in heating, there had been many complaints at the variations of temperature. Accordingly telemeters had been placed in various parts of the church and connected with the recording instruments in the sexton's pew, where is also a crank, which controls the supply of hot and cold air. All the sexton has to do is to watch the record of the temperature on the instruments in his pew, and regulate the supply of hot and cold air accordingly. I mention these facts to show under what circumstances of luxury religion may be cultivated in New York. And yet the clergymen of fashionable churches are constantly complaining of an increasing falling off in the number of churchgoers.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 53, a 56; B. & M., b 3, a 6; Mutual Union, b 14½; Postal stock, a 3; Postal sixes, a 24½; Western Union, b 58½, a 58¾.

The upward tendency of Western Union is attributed to a movement by Mr. Gould and his supporters against the short interest in the stock.

Telephone.—Am. Bell, b 223, a 224; Erie, b 20¾, a 21; Mexican, a 1½; New England, b 29¾, a 30; Tropical, b 1¼.

The Boston *Herald* of Feb. 18 says: Telephone shares were steady at 224 for Bell, 29¾ for New England and 21 for Erie. It looks as if there might be some restrictive legislation passed at the State House this winter.

Electric Light.—Edison, b 60, a 90; Am. Elec. & Illu. com., b 2, a 2¼.

BUSINESS NOTICES.

A. L. Bogart, Electrician, No. 22 Union Square, New York, manufacturer and sole owner of letters patent and licenses controlling every variety of electric gas-lighting apparatus for theatres, churches, public and private buildings, having by long experience and persistent effort acquired the best-known system of constructing as well as of applying the varied apparatus used in the lighting of gas-jets by electricity, has created an almost unlimited demand, employing improved machinery, tools and skilled workmen, resulting in the production of a vast variety of apparatus, both faultlessly and economically made.

The trade procure almost every article required in the electric line from Mr. Bogart at less than the same would cost to manufacture in limited quantities. Prices are based on a living profit only, above actual cost. Royalties on patent rights are not considered.

The attention of the trade and of consumers is respectfully called to the subjoined list of patents issued or assigned to or controlled exclusively by A. L. Bogart. The validity of the patents marked thus (*) has been confirmed by decrees of Judge Addison Brown, of the U. S. Circuit Court for the Southern District of New York, December 25, 1884:

LIST OF THE BOGART PATENTS.

Multiple Gas-Lighting Apparatus.

No. 93,563. Aug. 10, 1869, H. J. Smith, Frictional Machine.

No. 119,561. Oct. 3, 1871, A. L. Bogart, Glass or Porcelain Insulation in a Gas-Burner.

No. 194,328. Aug. 21, 1877, A. L. Bogart, Lava as an Insulator in a Burner.

No. 199,676. Jan. 29, 1878, A. Wright, Wire Electrode carried by a Lava Tip.

Single Hand Gas-Lighting Apparatus.

*No. 116,054. June 20, 1871, Heyl & Diehl, Combination of Cock, Movable and Fixed Electrodes in a Gas-Burner.

*No. 146,953. Jan. 27, 1874, A. T. Smith, Hand Lighter operated by Stop-Cock.

No. 152,427. June 23, 1874, A. T. Smith, Vibrator Burner.

No. 177,459. May 6, 1876, A. L. Bogart, Cock Burner and Method of Insulation.

*No. 180,832. Aug. 8, 1876, A. L. Bogart, Use of Pendant, Wire or Chain, to operate Spark-Producing Electrode in a Hand Burner.

No. 180,833. Aug. 8, 1876, A. L. Bogart, Cock Burner.

No. 202,694. April 23, 1878, A. L. Bogart, Fixed Arm Burner.

No. 203,406. May 7, 1878, A. L. Bogart, Insulation of Fixed Electrode by Collar on Lava Tip.

No. 206,272. July 23, 1878, A. T. Smith, Pivoted Bar-Electrode.

No. 209,016. Oct. 15, 1878, A. L. Bogart, Automatic Burner.

*No. 225,971. March 2, 1880, H. F. Packard, Ratchet Pendant Burner.

No. 259,267. June 6, 1882, A. L. Bogart, The Original Automatic Burner.

No. 279,634. June 19, 1883. A. L. Bogart, Automatic Circuit Cut-Off.

No. 282,043. July 31, 1883, A. L. Bogart, Candle Pendant Burner.

No. 290,732. Dec. 25, 1883, A. L. Bogart, Automatic Circuit Cut-Off.

No. 292,732. Feb. 5, 1884, A. L. Bogart, Automatic Circuit Cut-Off.

No. 292,786. Feb. 5, 1884, A. L. Bogart, Automatic Gas-Lighting Attachment for Burglar Alarms.

No. 306,128. Oct. 4, 1884, A. L. Bogart, Cock Burner.

*No. 7,249. Aug. 1, 1876, A. T. Smith, Reissue of No. 146,953.

Also for the States of New York, New Jersey and Pennsylvania:

No. 121,301. Nov. 28, 1871, J. P. Tirrell, Automatic Burner.

No. 121,302. Nov. 28, 1871, J. P. Tirrell, Automatic Burner.

No. 230,567. July 27, 1880, G. F. Pinkham, Hand-Lighter.

No. 230,589. July 27, 1880, J. P. Tirrell, Automatic Burner.

*No. 230,590. July 27, 1880, J. P. Tirrell, Automatic Burner.

All parties are hereby notified that infringers will be prosecuted for manufacturing, selling or using any gas-lighting apparatus covered by the foregoing list of patents, not obtained from A. L. Bogart or of his authorized agents. A. L. BOGART.

Feb. 19, 1885.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED FEB. 3, 1885.

Annunciator for Telephone Systems; William A. Childs, Englewood, N. J., and Frank Shaw, New York, N. Y..... 311,472

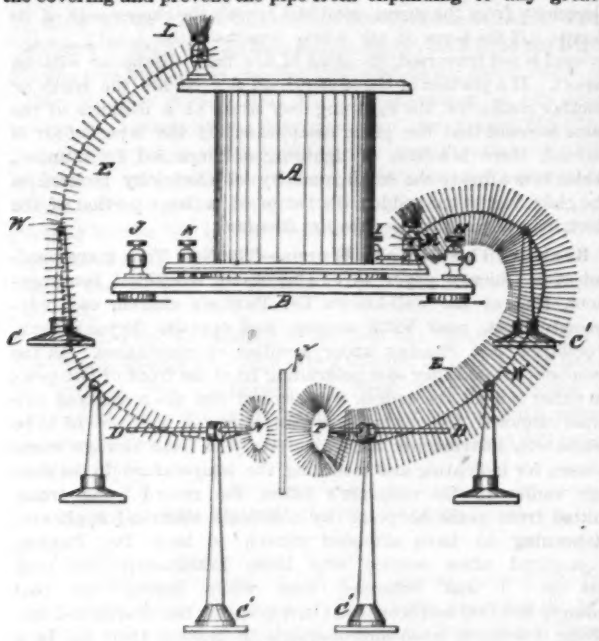
It consists in the combination, with a horizontal switch-board in which the apparatus for making the necessary connections and disconnections are accessible from the sides, of an annunciator arranged in a horizontal plane above the table, and which is provided with suitable indicator drops, whereby the number of the line from which the signal comes may be observed from two or more sides of the table by either of the operators.

Galvanic Battery Porous Cup; Charles P. Orne, Cambridge, Mass..... 311,516

The cell is composed of two tubes, differing in their sizes or diameters, and arranged one within the other with an annular space between them, and both connected at their lower ends by an annular bottom extending from one to the other of them, the inner tube being open at each end, and the said tubes and bottom being made of such material as is usually employed in the manufacture of the ordinary porous cells for galvanic batteries.

Telegraph Cable; William R. Patterson, Chicago, Ill., Assignor to the Western Electric Company, same place. 311,521

Relates to the loose braiding or jacket about the elastic tubes to prevent the internal pressure of the hot insulating substance as it is forced in from bursting the pipe, and to winding a serving about the jacket after the pipe has shrunk, so as to further strengthen the covering and prevent the pipe from expanding to any great



PATENT NO. 311,725.

extent in case the insulating substance should become warm or hot.

Method of Repairing Telegraph Cables; William R. Patterson, Chicago, Ill., Assignor to the Western Electric Company, same place..... 311,522

Consists in removing the lead pipe from the portion of the cable that has been damaged by moisture, and pouring upon the conductors of the core hot paraffin until the moisture is evaporated, and then inclosing the conductors thus dried with a sleeve of lead.

Means for Hanging Telegraph Cables; William R. Patterson, Chicago, Ill., Assignor to the Western Electric Company, same place..... 311,523

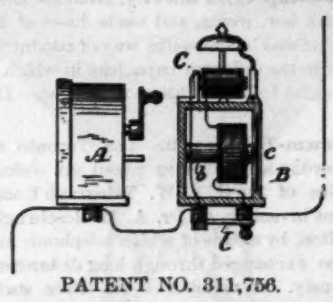
Consists in providing two parallel suspending-wires, hooking the hangers attached to the cable one after the other alternately to the different suspending-wires, so that the hooks on the different wires will face outwardly in opposite directions, whereby the cable is provided with two independent supports which reciprocally prevent the hooks from being thrown off from the said supports respectively.

Electric Arc Lamp; Barton B. Ward, Hartford, Conn., Assignor to Frank G. Waterhouse, Sacramento, Cal..... 311,546

Regulation is accomplished by locating the wire carrying the main current at the centre of the magnet, so that the iron, which extends out at both ends beyond said wire, will attract armatures which are employed for *separating* the carbons, and by locating the shunt-wire at one or both ends of said magnet at a point beyond where the armature or armatures are attracted by said magnet, the said shunt-current, in passing around said magnet, carries the poles produced by both the main and shunt currents to a point beyond the reach of the said armature, so that the part of the magnet used to attract the armature while magnetized by the main current becomes the neutral part of the magnet when acted upon or magnetized by the shunt-current, and thus allows the armature or armatures to fall away and cause the carbons to *approach* each other.

Dynamo-Electric Machine; Frank G. Waterhouse, Sacramento, Cal..... 311,547

The object is to wind the wire and direct the flow of the currents in the wire of the armature in such a way as to prevent the body of the armature from being magnetized by the wire on the armature. The armature has conductors which form a path for an electric current on the outside of the iron in the armature, and also a path for a current inside of the iron of the armature, wound



PATENT NO. 311,756.

and connected, whereby the current in the opposite conductors on the outside of the iron will flow in opposite directions, and the current in the opposite conductors on the inside of the iron will flow in opposite directions, and the current in the conductors on any one side of the armature will flow in the same direction, both outside and inside of the iron composing the armature.

Electrical Connecting Cord; William H. Sawyer, Providence, R. I..... 311,611

Relates to that class of cords which are provided with a non-conducting suspending cord or branch at one or both ends for sustaining the weight of the instrument and thereby taking the strain off the conductors.

Electric Circuit Connection; Thomas T. Smith, London, England (patented in England and France)... 311,616

Consists of a pair of protected spring terminals, sockets, or shoes inclosed within a perforated insulating-case adapted to be imbedded in a wall, skirting-board or other surface, so that the perforations are accessible, and of a pair of metal hooks mounted obliquely on a block of insulating material and connected, respectively, with the flow and return wires of the conductor, by which the current is conveyed to and from the lamp or lamps or elsewhere, the said hooks being of a size and form to enter the perforations in the insulating-case containing the terminal sockets or shoes and make efficient metallic contact therewith.

Portable Electric Lamp; Thomas T. Smith, London, England (patented in England and France)..... 311,617

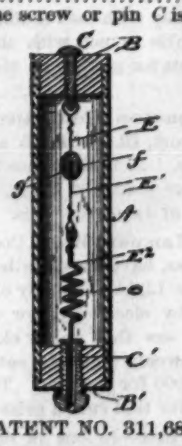
Consists in the adaptation thereto of a flexible conductor or cord containing both the flow and return wires, suitably insulated, in combination with a hand winch or reel for winding up or paying out the cord.

Electric Battery; Alden M. Young, Waterbury, Conn., Assignor of one-fourth to David S. Plume, same place..... 311,630

Consists in the combination, with a battery-jar and its cover and a negative electrode, of a zinc electrode consisting of a rod adapted to be entirely immersed in the battery-liquid, and having a cavity for quicksilver (which preserves the amalgamation) in its upper end and an insulated conductor fixed in the zinc electrode and extending upward therefrom through the cover.

Electric Circuit Opener; William H. Sawyer, Providence, R. I..... 311,681

To the inner end of the screw or pin *C* is attached one end of a



PATENT NO. 311,681.

piece of fine platinum *E*, the opposite end of which is lapped and preferably slightly twisted, as shown at *f*, with the end of another platinum wire *E'*, which has its other end looped to a heavier wire E^2, which is coiled or bent, as shown at *e*, to form a spring. The joint *f* between the two wires is secured by imbedding it in a mass *g*, of readily-fusible non-metallic adhesive substance which melts at a low temperature—for example, a cementing wax such as is used by jewelers in securing small articles to lathe-mandrels. A non-metallic substance—such as wax—is preferable for imbedding the lap-joint, for the reason that it permits a more prompt breakage of electrical connection between the wires than is permitted by metallic solder.

Electric Circuit; William A. Shaw, Brooklyn, Assignor to Charles A. Cheever, Trustee, New York, N. Y. 311,682

Prevents induction by winding a portion of the circuit spirally with a second portion of the same circuit.

Demonstrative Electrical Apparatus; James D. Culp, San Felipe, Cal..... 311,725

A is a condenser of peculiar construction; being such that when it discharges between the points *H* and *I*, a shunt discharge also occurs between *N* and *P*; and under certain easily obtainable conditions the wires *W* and *W'* become luminous, and have an appearance of radiating lines as shown. In the condensers, the ordinary tinfoil outer covering is replaced by a coil of wire, which should be proportioned by experiment.

Audible Quotation-Indicating System; F. Benedict Herzog, New York, N. Y.....311,756 and 311,757

Consists in transmitting over the circuit groups consisting of one or more electrical signals of one character or quality—such as single impulses or clicks—and also groups consisting of one or more electrical signals of a different character—such as buzz-signals—clearly distinguishable from the others, the two kinds of signals being made to follow each other in different conventional combinations prearranged to denote the desired facts, and being made audible at subscribers' offices by receiving instruments, each of which is adapted in itself to reproduce both classes of signals, whereby the signals are made understandable and received without the use of automatic printing instruments, and the necessity of attendance is avoided. At each subscriber's office is placed in circuit a receiving device *B*, for rendering audible the signals indicating the quotations. This device consists of a box containing an electro-magnet *b*, provided with a diaphragm-armature *c*, forming a telephonic receiver; but an ordinary telegraph-sounder or any suitable sounding instrument may be employed instead.

PATENT NO. 311,852.

To this box is also attached a single-stroke electric bell *C*, which is also placed in circuit and is arranged to ring on the backstroke of its armature when the circuit is broken in the customary closed-circuit systems.

Rheostat; John Doyle, Hoboken, N. J., Assignor to himself and C. Coles Dusenbury, White Plains, N. Y.. 311,820

He envelopes conductors of different specific resistance in a case formed of poor radiators of heat.

Knob for Electric Gas-Lighting Apparatus; F. Lane, Boston, Mass., Assignor to Thomas C. Frenyear, Exeter, N. H., and Lloyd E. Razee, Attleborough, Mass..... 311,840

Consists in the application of luminous paint to the inside of a glass bulb, located below the apparatus, so that it remains visible throughout the night and therefore at such times as it is desired to turn on the gas.

Indicator for Railroad Switches; Gilbert Otte, Apeldoorn, Holland (patented in Belgium, France, England and Italy)..... 311,846

The object is to furnish a means of controlling the position of a railway-switch in such manner that it may at all times be known what position it occupies. To this end he employs a contact-box placed directly upon the track between the rails of each switch, and electrically connects such box, both with a central or special signal-station and with one or more indicators placed along the track at various points for the warning of train-men.

Carbon Battery Element; Isaiah L. Roberts, Brooklyn, N. Y., Assignor of one-half to Henry L. Brevoort, same place..... 311,852

The metal or alloy *C* must be such as will expand on cooling, as does type-metal, antimony or bismuth, which when cooling expands and forces itself firmly against the walls of the carbon, and thus makes a joint.

Electric Battery; Isaiah L. Roberts, Brooklyn, N. Y., Assignor of one-half to Henry L. Brevoort, same place. 311,853

Consists in adding to sal-ammoniac electrolytes a soluble depolarizer—for example, a mixture of bichromate of potash and permanganate of potash.